

SCIENCE AND TECHNOLOGY COMMITTEE

Fifth Report

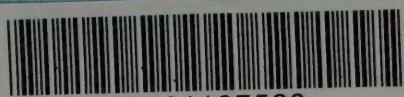
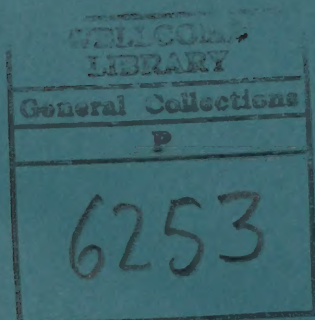
**GOVERNMENT EXPENDITURE ON
RESEARCH AND DEVELOPMENT:
THE FORWARD LOOK**

Volume II

Appendices to the Minutes of Evidence

*Ordered by The House of Commons to be printed
29 March 2000*

PUBLISHED BY AUTHORITY OF THE HOUSE OF COMMONS
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The Science and Technology Committee

The Science and Technology Committee is appointed to examine on behalf of the House of Commons the expenditure, administration and policy of the Office of Science and Technology (and any associated public bodies). Its constitution and powers are set out in House of Commons Standing Order No. 152.

The Committee has a maximum of eleven members, of whom the quorum for any formal proceedings is three. The members of the Committee are appointed by the House and unless discharged remain on the Committee until the next dissolution of Parliament. The present membership of the Committee is as follows:¹

Dr Michael Clark MP (*Conservative, Rayleigh*)²
Mrs Claire Curtis-Thomas MP (*Labour, Crosby*)²
Dr Ian Gibson MP (*Labour, Norwich North*)²
Dr Brian Iddon MP (*Labour, Bolton South East*)⁵
Mr Robert Jackson MP (*Conservative, Wantage*)³
Dr Lynne Jones MP (*Labour, Birmingham Selly Oak*)²
Mr Nigel Jones MP (*Liberal Democrat, Cheltenham*)²
Dr Ashok Kumar MP (*Labour, Middlesbrough South and East Cleveland*)²
Mr Ian Taylor MP (*Conservative, Esher and Walton*)⁴
Dr Desmond Turner MP (*Labour, Brighton Kemptown*)²
Dr Alan W Williams MP (*Labour, Carmarthen East and Dinefwr*)²

On 30 July 1997, the Committee elected Dr Michael Clark as its Chairman.

The Committee has the power to require the submission of written evidence and documents, to examine witnesses, and to make Reports to the House. In the footnotes to this Report, references to oral evidence are indicated by 'Q' followed by the question number, references to the written evidence are indicated by 'Ev' followed by a page number.

The Committee may meet at any time (except when Parliament is prorogued or dissolved) and at any place within the United Kingdom. The Committee may meet concurrently with other committees or sub-committees established under Standing Order No. 152 for the purposes of deliberating, taking evidence or considering draft reports. The Committee may meet concurrently with the House's European Scrutiny Committee (or any of its sub-committees) or the Environmental Audit Committee for the purposes of deliberating or taking evidence. The Committee may exchange documents and evidence with any of these committees, as well as with the House's Public Accounts and Deregulation Committees.

The Reports and evidence of the Committee are published by The Stationery Office by Order of the House. All publications of the Committee (including press notices) are on the Internet at www.parliament.uk/commons/selcom/s&thome.htm. A list of Reports of the Committee in the present Parliament is at the end of this volume.

All correspondence should be addressed to The Clerk of the Science and Technology Committee, Committee Office, 7 Millbank, London SW1P 3JA. The telephone number for general inquiries is: 020 7219 2794; the Committee's e-mail address is: scitechcom@parliament.uk.

¹ Mrs Caroline Spelman MP (*Conservative, Meriden*) was appointed on 14 July 1997 and discharged on 22 June 1998. Mr David Atkinson MP (*Conservative, Bournemouth*) was appointed on 14 July 1997 and discharged on 30 November 1998.

Mrs Jacqui Lait MP (*Conservative, Beckenham*) was appointed on 22 June 1998 and discharged on 5 July 1999.

Mr Nigel Beard MP (*Labour, Bexleyheath and Crayford*) was appointed on 14 July 1997 and discharged on 20 March 2000.

² Appointed on 14 July 1997.

³ Appointed on 5 July 1999.

⁴ Appointed on 30 November 1998.

⁵ Appointed on 20 March 2000.

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UNPRINTED MEMORANDUM

An additional Memorandum has been received from the following and has been reported to the House, but has not been printed. A copy has been placed in the House of Commons Library where it may be inspected by Members. Another copy is in the Record Office, House of Lords, and is available to the public for inspection. Requests for inspection should be addressed to the Record Office, House of Lords, London, SW1. (Tel 020 7219 3074). Hours of inspection are from 9.30 am to 5.30 pm on Mondays to Fridays.

1. Annex to Memorandum submitted by Silsoe Research Institute

APPENDICES TO THE MINUTES OF EVIDENCE

SUBMITTED TO THE SCIENCE AND TECHNOLOGY COMMITTEE

APPENDIX 1

Letter to the Clerk of the Committee from Professor John R Helliwell, Department of Chemistry, University of Manchester

I wish to raise the issue of the present state of organisation of UK scientific research at the interdisciplinary science interface, namely at the junction between biology, chemistry and physics as encapsulated by my research in protein crystallography and molecular biophysics.

A. BACKGROUND INFORMATION AND PERSPECTIVE:

- (i) Upon the break-up of SERC, and my attempts to work within the new split structure of BBSRC and EPSRC in my biophysics and protein crystallography research I have, after some considerable dislocation, largely moved my research funding mechanisms to a combination of Wellcome Trust and international agency research grants (EU, British Council) as well as The Royal Society. I simply could not get a sensible match between excellent referees' reports on my research grant submissions to BBSRC and EPSRC and the reject/referral decisions of BBSRC and EPSRC that I would then receive.
- (ii) I have solved the ancillary aspect of my synchrotron radiation beam time needs and provision, ie since BBSRC and EPSRC control SRS "tickets" allocations, by largely moving to international SR sources for my research. This includes ESRF in Grenoble but I also make heavy use of SR sources in the USA (CHESS, NSLS and APS) as well as in Italy. For neutron beam time I can apply directly to Grenoble (as with ESRF). Sadly the RAE then misses a considerable tranche of beamtime equivalent funding, and indeed RAE assessments are in fact thereby largely meaningless in the interdisciplinary areas of research.

B. ATTEMPTS TO RAISE THE ISSUE:

- (i) I have taken this issue up with an official at OST, who I met at a British Council research evaluation in Tel Aviv last year, and was informed by him that Taiwan is now organising its research funding on subject lines like the UK.

This is not an acceptable answer.

- (ii) I have presented these points to BBSRC and EPSRC officials but who have *not* written to answer them.
- (iii) I have alerted my University colleagues to this damaging state of affairs for this area of research, which impacts upon the type of research funding that I now obtain which, apart from my EU funding, does not attract overheads.
- (iv) I have aired my views on the state of UK research organisation in a public discussion and answer session with the Director General of the Research Councils Dr John Taylor at the Daresbury Users' meeting 1999.

I did not receive a satisfactory answer from him either.

C. SUMMARY

I have to conclude then that to move forward, my views have to be targeted at a yet higher level. Hence my letter now to the House of Commons Science and Technology Committee.

So, overall, I feel that this is a disgraceful situation that the UK scientific research councils should impede research at the interdisciplinary science interface.

Nowhere else in the world, apart from Taiwan, organises its research funding on these tight subject lines. Indeed the very opposite whereby interdisciplinary subjects are always, rightly, portrayed as being the most likely next steps for research breakthroughs.

Moreover, the challenges met in society today with issues of health and agriculture rest on scientific methodology and results which simply do not respect the tight subject boundaries of our UK Research Councils. Indeed, tight subject boundaries, whilst appropriate for undergraduate science training, is a juvenile method of organising Britain's Research enterprise. The Wellcome Trust, apart from not providing for overhead costs in its research grants, is a model of sensible handling of such areas of interdisciplinary science research.

16 November 1999

APPENDIX 2

Letter to the Clerk of the Committee from Professor Martin Raff, Chairman of the UK Life Sciences Committee

The UK Life Sciences Committee comprises 13 leading learned societies and represents over 30,000 researchers in universities, public sector research institutes, and industry.

The UKLSC is pleased to endorse the separate response to this consultation from the Institute of Biology, in particular the comments about the adverse effects of the decline in real terms over the last decade of total government spend on science, engineering and technology. The need to increase the level of R&D spending by government departments, in order to restore and retain a proper balance of fundamental and long-term research in universities and research institutes, was one of the main recommendations for government science policy to arise from a survey of member societies over the summer.

The UKLSC notes the comment by Sir Richard Sykes on the Committee for Science and Technology report on the co-ordination of science across government departments: "The biggest issue is the constant withdrawal of funds, making departments and ministries less able to respond quickly to situations as they occur. The other major issue is the lack of long-term strategies" (THES, 15/10/99). The UKLSC also notes and endorses the view of Dr Michael Clark MP, expressed in an article to celebrate the 60th anniversary of the Parliamentary and Scientific Committee, that government needs to put sufficient money and attention to "front-end loading" to ensure policy success, rather than "back-end loading" for fire-fighting after disastrous policy failure (Science in Parliament, Vol 56, No 4, 1999).

22 November 1999

APPENDIX 3

Memorandum submitted by the Royal Astronomical Society

The Royal Astronomical Society (RAS) welcomes the decision of the S and T Committee to conduct a brief inquiry to examine the levels of spending across Government on research and development, and to determine the use that is made of these budgets to address Foresight and Ministerial objective. The RAS will be willing to contribute in any way it can, within its expertise, to help achieve these aims.

In preparing this response, the RAS is struck by the number of organisations involved in contributing to science policy. As a result, it is often difficult to obtain a clear picture of the total UK spend in research and development, and of the measures of success that are attained in achieving objectives.

For example, there are currently several investigations related to the S and T study, now being pursued, on which the RAS has been asked to comment. These include the Trade and Industry inquiry into UK Space Policy, the HEFCE review of research policy and funding, and the review by the Institute of Physics and other bodies of the Standing and Potential of Physics Research in the UK. It is to be hoped that the findings of these investigations can be used to inform the S and T discussions, and that a coherent rather than fragmented picture of UK research and development can be presented.

Therefore, the RAS hopes that some emphasis will be given in the S and T inquiry to the final bullet point of the Call for Evidence; i.e., the means by which a clear picture of current spends and trends, and of measures of success in achieving aims and objectives, may be made.

22 November 1999

APPENDIX 4

Letter to the Clerk of the Committee from Mr Brian Robinson, the Institution of Mechanical Engineers

In response to your request for written submissions on the above topic, I am pleased to present the following comments on behalf of the Institution of Mechanical Engineers, which exists to represent the views and combined expertise of its 82,000 members. We shall, of course, be happy to supply more information and comment should you need it.

There is a well established link between R&D activity and industrial productivity and competitiveness. Countries such as Finland and Sweden have clearly demonstrated how investment in R&D has improved the competitiveness of industry. The UK still lags well behind its major competitor nations in how much of its wealth it invests in R&D, both that funded by government and by industry.

The break-up of the major utilities, and the pressures imposed by their regulatory regimes, has increased competition but has also significantly reduced investment in R&D. There is insufficient incentive for UK

suppliers to increase their R&D to compensate, and the result is that the UK is becoming a net importer of technology in this sector.

The government should have a clearly stated aim of increasing gross domestic expenditure on R&D (GERD), as a percentage of GDP to match or better the G7 average by 2004 (1996 figures, UK 1.94 per cent, G7 2.40 per cent).

We welcome the fact that government expenditure on R&D is set to increase by 10 per cent, in real terms, over the next three years. This will improve the situation with regard to government expenditure on R&D, but is unlikely to significantly close the GERD gap with our major competitors. As well as increasing its own investment in R&D, the Government must take radical steps to encourage greater R&D activity in UK industry, particularly involving SMEs. It must also encourage investment in R&D capabilities, invention, innovation and engineering skills.

OST has a key role in promoting priorities identified by the Foresight programme. A challenge, which has yet to be successfully addressed, concerns the implementation of the Foresight findings within the SME sector.

The Government's Forward Look document should clearly state the Vision and Objectives for government R&D expenditure, and thus help to guide and influence business R&D planning and activity. The Objectives should be based on Foresight findings and be capable of interpretation by SMEs.

22 November 1999

APPENDIX 5

Memorandum submitted by the Institute for Animal Health

EXECUTIVE SUMMARY

1. The continuing pressure on funding through a combination of reduced budgets, increasing fragmentation of funding sources within Government and the move to short-termism, is making it increasingly difficult for institutes such as the Institute for Animal Health to plan for the long-term provision and maintenance of resources, many unique, in order to meet their responsibilities to the UK.

2. The assumption that the Institute's sponsoring body, the BBSRC, can provide all the necessary funds for the maintenance of these resources is untenable in the present circumstances.

3. A new mechanism needs to be found to safeguard those resources including key scientific staff, specialist buildings and animal lines that are essential for the long-term research base of the UK.

4. The Institute has significant problems in recruiting and retaining staff, due to uncompetitive salaries and the insecurity inherent in short-term contracts. This is especially felt where staff are required to have veterinary qualifications.

BACKGROUND

5. Disease, especially infectious disease, is a constant threat to the well-being of the nation, both animals and humans. Even under "normal" conditions the cost of infectious disease in farm animals is around £1.7 billion a year. The additional cost of a major epidemic like BSE or foot-and-mouth disease would range between £1 billion and £4 billion. Nor are the costs limited to the farm. The zoonoses, such as *Salmonella*, *Campylobacter*, *E coli*, *Listeria*, generate significant costs in human health.

6. Infectious diseases are dynamic. As a result "old" diseases may become able to evade currently effective treatments, whilst entirely new diseases emerge from time to time. On average, a new disease of animals is recognised once every two years.

7. In the light of the above, it is clear that infectious diseases cause much suffering, can impair food supplies and their quality, ruin the farmer, threaten local and national economies and inflict problems internationally. It is entirely prudent, therefore, that for the public good, the Government should ensure that there is a vigorous research programme to limit the effects of disease and that the skills base and the appropriate matching resources should be available to tackle any new emergency swiftly and effectively.

8. The reality is the reverse:

- (1) Although Government funding of science, through OST, increased following the last competitive spending review, Departmental spend on R&D has, in some cases, fallen markedly. This was the case for research funding by MAFF and followed a decade of decline in the allocations to agricultural research.

- (2) Constant improvements in regulations affecting the case and welfare of animals under experiment, pollution, etc, whilst very welcome in themselves, increase costs and require an ever-greater share of the research funds. No provision is made for additional funding to meet the increased costs that accompany increased regulation.
 - (3) Funding is increasingly short-term, jeopardising the maintenance of facilities that are required in the long-term.
 - (4) Short-term-ism also means that research workers are normally offered only temporary contracts. Forging a career in science is becoming increasingly difficult. Poor salaries and lack of opportunities exacerbate the problem.
9. The remainder of this paper considers the specific experiences of the Institute for Animal Health (IAH), the UK's major centre for basic and applied research on the infectious diseases of farm animals.
10. During the past decade the IAH has been obliged to cease its productive and important research into the following:
1. Rotaviruses
 2. Infectious stunting syndrome
 3. Influenza
 4. Transmissible gastroenteritis of pigs
 5. Atrophic rhinitis
 6. Swine dysentery
- whilst at the same time reducing, sometimes to an absolute minimum, research on
7. Respiratory infections of calves
 8. Mastitis
 9. Oncogenic virus diseases of poultry
 10. Respiratory disease in poultry
 11. Enteric diseases of poultry, particularly coccidiosis
 12. Immuno-suppressive diseases of poultry
 13. Food-borne zoonoses.
11. Quite properly, there have been new areas of work developed:
1. Bovine spongiform encephalopathy and other transmissible spongiform encephalopathies.
 2. Bovine tuberculosis.
 3. Genomics, both of pathogens and the host farm animals.
 4. Pig immunology.

THE PROBLEM

12. Against this entirely normal, dynamic background of scientific endeavour there have been two worrying trends both triggered by pressure on funds—an increasing emphasis on short-term funding and an unwillingness by funders to meet the true costs of research (the “overheads” issue). At the same time two factors have exacerbated the situation. They are firstly, an increase in the number of funding bodies, each with its bureaucracy, yet working within the same financial ceiling and, secondly, scientists' salaries.

SHORT-TERM FUNDING: PHYSICAL RESOURCES

13. Prior to 1972, the IAH received over 90 per cent of its funds from a single source, namely the Agricultural Research Council (now the Biotechnology and Biological Science Research Council—BBSRC), its sponsor. With the adoption of the Rothschild principle at that time, two major funders emerged, the Research Council and the Ministry of Agriculture, Fisheries and Food (MAFF). Over time other funding bodies have commissioned specific projects in the IAH. These include the Medical Research Council, the Overseas Development Agency (now Department for International Development) and the Department of Health, whilst new funding opportunities were created by the EU and other international funding agencies. The Food Standards Agency is expected to become a new customer for IAH research from April 2000. Private industry funding has also been encouraged.

14. Whilst institutions such as the IAH has welcomed this enlarged customer base, they have had to manage the consequences of an increasing proportion of their funding being short-term, typically projects run for three years. Since 1988–89, short-term funding in the IAH has risen from less than one fifth to the current figure of around three-quarters. The only long-term commitment is the IAH's sponsor, the BBSRC. Its contribution to the budget through the competitive strategic grant (£6.1 million in 1999–2000) is less than half the sum needed to maintain the unique and indispensable resource of the IAH. Thus a substantial part

of the money needed to maintain IAH's facilities for the long-term, is drawn from the overhead component on externally funded, short-term projects.

15. The resources at the IAH are crucial to the UK's capability to respond effectively to existing problems and new crises in animal health. They include:

1. Internationally competitive, multi-disciplinary research teams able to work at any level from molecules to populations of animals.
2. High containment laboratories to enable safe handling of pathogens, including the agent of Creutzfeldt-Jakob disease and tuberculosis.
3. Uniquely able to study disease pathogenesis in the host animal (host-pathogen interactions).
4. Animals of known health status, including SPF and gnotobiotic animals.
5. Animals of defined genetic status.
6. Capability for producing transgenic animals.
7. A full range of animal accommodation (conventional to MAFF category 4).
8. In-depth knowledge of disease in the natural host.
9. Wide range of model infections.
10. Unique collection of strains, including reference strains, of pathogens.
11. An international reputation for the disease surveillance and contract research.

16. As noted in paragraph 14, the sole source of long-term funding is the BBSRC. Also noted in that paragraph is the fact that the maintenance of these essential resources costs more than twice the annual competitive strategic grant, i.e., £6.1 million compared with £14 million. Obviously part of the grants received from the Institute's other customers is directed to meeting these costs. But it is becoming increasingly common for research grants to offer only marginal costs rather than full economic costs, thus contributing to the demands put on the competitive strategic grant.

SHORT-TERM FUNDING: HUMAN RESOURCES

17. In managing the uncertainties inherent in short-term contracts, the IAH increasingly is obliged to offer scientists short-term contracts. Typically these will run for three years. Occasionally it is possible to offer a second term, also temporary, to some of these highly trained and valuable research workers, but the opportunities for permanent contracts based on planned stable funding is low.

18. Currently, 66 per cent of the science staff of the IAH are on short-term contracts. The prospects of substantially improving career opportunities are poor unless there is a significant change in the policy of funding research institutes such as the IAH.

19. On the global scale the training provided by the IAH to young postdoctoral staff must be seen as a force for good, given that infectious diseases are mostly international problems and we accept our role in training scientists for the wider research community. However, for the Institute itself and for the UK, the need to train staff only to see them leave after three years is both demoralising for the remaining research scientists and a waste of the nation's money.

20. With over 30 per cent of IAH's funds coming from one departmental source (MAFF) in the form of short term contracts, delays in approval of projects and final reports, and other administrative issues, can contribute to significant financial management problems for the Institute.

CONSEQUENCES OF PROLIFERATION

21. The proliferation of Government funding bodies has left the BBSRC with financial responsibilities that it cannot meet alone. Given that MAFF (with the BBSRC the major customer of the IAH) is required to move progressively to short-term funding and that the monies available to the IAH show no sign of stabilising, there must be serious concerns about safeguarding long-term viability, not just in terms of its research facilities and capabilities but also the statutory services provided on behalf of the State Veterinary Service.

22. It is not sufficient for MAFF to adopt the role of a customer and claim that it has no responsibility to help maintain the only contractor able to supply research to meet some of its policy requirements. MAFF already recognises that it has a duty to maintain as far as possible expertise over a wide spectrum of veterinary and biological science. As a result of earlier policy decisions, that expertise is now becoming dangerously thin.

23. A new mechanism needs to be found to safeguard those resources that are essential for the long-term including key scientific staff, specialist buildings and animal lines. Encouraging flexibility to accommodate changing priorities is also important, but a separate, and secondary, issue.

OVERHEADS

24. Too many potential customers expect to pay only the marginal costs incurred through the prosecution of the research needed to meet their requirements. The costs of maintaining, let alone extending, the resources necessary for carrying out that research are conveniently ignored. Other potential customers recognise the need to pay something towards the overhead costs, but set arbitrary ceilings. Thus with overheads costing around 80 per cent of the “research” element, most funders, including some Government agencies, accept no more than 40 per cent and there is a significant minority that offers less.

SALARIES

25. Most scientists in the public sector are poorly paid in comparison with those outside. Given that their science is international, many quickly give up the struggle and join the “brain drain”. Not only are the starting salaries generally low compared with other professions, many of which do not require such long training periods, but once appointed the scientist cannot look forward to comparable pay progression during the period of the contract.

26. It is not uncommon for the IAH to have to advertise two or three times to fill a scientific post. Attracting qualified veterinarians with a research background is especially difficult.

23 November 1999

APPENDIX 6**Letter to the Clerk of the Committee from the Professor C J Pollock, Director of Research, Institute of Grassland and Environmental Research**

I am making a submission on behalf of The Institute of Grassland and Environmental Research (IGER). The Institute is one of eight BBSRC-sponsored Institutes and carries out a range of basic, strategic and applied studies in support of grassland agriculture and sustainable land management practices. IGER also employs its expertise across a range of related activities including the breeding of amenity grasses and applied phytochemistry.

The Institute has an annual income of approximately £14.6 million, which it receives from a variety of sources. It is supported by BBSRC via the Competitive Strategic Grant, which amounted to £3.7 million in the 1998–99 financial year. The remainder of its funding is project based and comes from a wide range of government, levy boards and industrial sources. The largest component of project-based funding is received from MAFF, amounting to some £6.9 million over the same period.

An analysis of MAFF income indicates two trends. Firstly, there is a decline in value associated with a reduction in the MAFF R&D budget. In IGER’s case there has been a 13 per cent reduction in cash terms since 1996, with further reductions in the pipeline. Secondly, there has been a shift away from long-term commissioned research towards 3- and 4-year packages that have an increased level of competitive tendering. MAFF and other government departments have also indicated explicitly that their research is funded to support policy issues within their remit. Although we accept the need for policy-driven research and the value of competition between research providers, we are concerned that the balance has now shifted to the detriment of long-term strategic research.

Institutes like IGER now find it increasingly difficult to sustain a cohesive research portfolio that can address the current and future research needs of their beneficiary community. Instead, they are required to seek industry funding or co-funding to replace losses from elsewhere. Such funding is almost entirely problem-oriented and leads to an increased level of “mission drift”.

We believe that there would be value in the OST adopting a more active role in promoting the strength and stability of the UK science base in discussions with other government departments. We feel that this would generate added value both in terms of optimal use of resources and in terms of the protection of scientific capacity without compromising the ability of individual departments to meet policy needs. The original basis upon which funding was transferred from the Research Council to MAFF was to improve relevance and generate added value. We believe that these goals should be balanced against a coherent view of science capacity across the UK.

I hope that these comments are of some value to the Committee. Please do not hesitate to contact me again if you require clarification or further information.

23 November 1999

APPENDIX 7

Memorandum submitted by the Institute of Biology, the Association of Applied Biologists, the Association of Clinical Cytogeneticists, the Association of Clinical Microbiologists, the British Association for Cancer Research, the British Association for Lung Research, the British Association for Psychopharmacology, the British Association for Tissue Banking, the British Ecological Society, the British Electrophoresis Society, the British Grassland Society, the British Phycological Society, the British Society for Animal Science, the British Society for Immunology, the Freshwater Biological Association, the Institute of Horticulture, the Institute of Trichologists, the Marine Biological Association, the Nutrition Society, the Scottish Association for Marine Science, and the Society for the Study of Fertility

1. The Institute of Biology is the independent and charitable body charged by Royal Charter to represent UK biologists and biology. It is well placed to respond to consultations on biological topics, not only because of its 16,500 members' expertise, but the specialist knowledge of its 76 learned Affiliated Societies. This response itself is a collaborative one between the Institute and the Association of Applied Biologists, the Association of Clinical Cytogeneticists, the Association of Clinical Microbiologists, the British Association for Cancer Research, the British Association for Lung Research, the British Association for Psychopharmacology, the British Association for Tissue Banking, the British Ecological Society, the British Electrophoresis Society, the British Grassland Society, the British Phycological Society, the British Society for Animal Science, the British Society for Immunology, the Freshwater Biological Association, the Institute of Horticulture, the Institute of Trichologists, the Marine Biological Association, the Nutrition Society, the Scottish Association for Marine Science, and the Society for the Study of Fertility.

SUMMARY

2. This response's principal points include:

- (a) Government funding of science is vitally important to the competitiveness of the national economy and to the development and implementation of Government policies.
- (b) A survey of IoB Affiliated Societies (specialist biological and learned groups) in 1997 revealed that real-term level funding for UK R&D was their top concern. Regrettably since then to 1998–99 Grand Total SET (Science Engineering and Technology) Expenditure has continued to decrease.
- (c) While the Science Base has been maintained, the total Governmental spend on science, engineering and technology (SET) has declined in real terms since the beginning of the 1980s.
- (d) The decline in real-term funding is affecting UK SET in a number of ways, including detrimental effects to long-term research programmes, the way overheads are accounted for, to scholarship activities, and to scientists' career development.
- (e) Not only has UK science yet to benefit from the peace dividend, it has suffered due to the decline in common resources shared with defence-related SET.
- (f) We understand that the Office of a Science and Technology's (OST) pan-Departmental role is restricted to SET matters other than funding, and that Departments independently negotiate with the Treasury for their funding. Resources may therefore fail to relate to aspirations.
- (g) Forward Look is a most useful publication. However, the more succinct nature of the 1999 edition lowers its utility. The time horizon of the funding tables would benefit from being lengthened to two decades.

GENERAL POINTS

Requirement for public funding

3. Government funding of science is vitally important to the competitiveness of the national economy and to the development and implementation of Government policies. The public funding of basic, strategic and applied research must be designed to improve the public assurance, the quality of people's lives and the competitiveness of the UK economy. In the latter area, in particular, complementarity of publicly funded research and industrially-funded research presents opportunities as part of the government's wider initiatives in creating prosperity through public-private partnership.

The biological community continues to be concerned by the decline in Governmental funding

4. A survey of IoB Affiliated Societies (Specialist biological and learned interest groups) in 1997 revealed that real-term level funding for UK R&D was a top priority. Since then to 1998–99 Grand Total (Science, Engineering and Technology) (SET) funding has been cut in real terms by £119 million (or £91.3 million excluding The National Health Service (NHS) R&D).

The real-term Grand Total expenditure on SET has declined over two decades

5. While the UK Science Base (the funding primarily by the Research and University Funding Councils) has maintained its funding in real terms, the decline in Government Departments and Defence has been so great that the Grand Total expenditure on SET in real terms has declined between 1986–87 and 1998–99 by over 13 per cent (or 18.7 per cent excluding NHS SET). The real-term decline since the beginning of the 1980's is bigger than this. Placing this in a strategic context, it might reasonably be expected that UK SET could continue to develop with level real-term funding. However the cost of engaging in science has increased due largely to extra equipment and consumable (ex: modern bio-reagents) costs; therefore a more equitable level of funding would be based on a proportion of UK Gross Domestic product—enabling investment in science to grow as the economy grows. Consequently, the long-term trend of decline in real-term investment is cause for concern.

While funding has declined, emphasis on the customer-contractor relationship and short-term contracts has increased. This current balance is detrimental

6. So as to improve financial efficiency the customer-contractor relationship has increased in importance within various branches of Government funded research. This has led to a reduction in long-term research and an increase in the number of short-term contracts. Today, short-term contracts dominate many areas of Government funded research. This domination is having a detrimental effect on the development of appropriate skills and knowledge in young scientists as well as depriving them of career structure. The Institute of Biology has recently produced a discussion document on *Environmental Policy and Long-Term Research* that is currently receiving widespread support.

Terminology is confusing. The "Science Budget" is not the Government's budget for science

7. It should be remembered that the "Science Budget" does not, as it might reasonably seem, refer to the Government's total spend on UK Science, Engineering and Technology (SET) but only to the Research Councils' funding. While this in itself represents (in 1998–99) nearly 55 per cent of the UK Science Base Funding it is only some 20 per cent of the total Government spend on SET. In addition to the Research Council's "Science Budget" (which when added to the University Funding Councils, Budget form the Science Base), there is both the Civil Department SET budget and the Defence SET budget. That the UK Science Budget SET does not refer to the total Governmental spend on SET can unwittingly lead to those being unfamiliar with the terminology being misled.

Civil and the Science Base have not fully benefited from the peace dividend

8. Not only has UK Science yet to benefit from the peace dividend, as defence R&D has markedly contracted, the rest of state-funded science has suffered due to the decline in common resources shared with defence-related R&D. Civil Departmental Science and the Science Base researchers not only can share some resources with those engaged in Defence research, but in part rely on non-Government industries for goods and services. These same industries are also active elsewhere in the economy. Consequently, a decline in Defence R&D not only has an effect on non-Defence R&D, but elsewhere in the economy too.

Government Department resources may not enable the realisation of aspirations

9. We understand that the Office of Science and Technology's (OST) pan-Departmental role is restricted to SET matters other than funding, and that Departments independently negotiate with the Treasury for their funding. This means that while the OST is responsible for co-ordinating science matters across all the Government Departments, it has no say in how each Department funds its own science. There is therefore a real risk that Departmental SET resources may fail to relate to realising OST aspirations.

Despite excellent UK research, industry is missing out. This might be explained by funding, and is worthy of investigation

10. There is evidence to suggest that this is already happening. It is acknowledged that while on one hand the UK SET compares favourably with other developed nations (for instance in terms of £ spent per primary research paper and citation impacts), but less well in turning science into technology in the market place. As noted above, the SET Base has been maintained in real-terms over the past two decades, while the Civil Department SET has contracted. Broadly speaking the SET Base is more related to "Research" than "Development"; while the "Civil Department SET" is more "Development" related. It would seem that performance is mirroring funding. Whether or not this perception has any real validity has yet to be determined, but we note that it is probably worthy of investigation.

A comprehensive annual Forward Look report is welcome

11. The OST's *Forward Look* is a most useful publication. That definitions relate to the *Frascati Manual* facilitates international comparisons. However, the more succinct nature of the 1999 edition lowers its utility compared to the previous larger volume with an accompanying Executive Summary booklet. The time horizon of the report's funding tables would greatly benefit from being lengthened to two decades to facilitate the strategic view.

12. Should the Select Committee require further information, please contact Jonathan Cowie, Institute of Biology, 20–22 Queensberry Place, London SW7 2DZ. In line with Government Policy on openness, the Institute is pleased to make this response publicly available and will be shortly placing a version on www.iob.org.

Reference

The financial data quoted comes from Office of Science and Technology (1999). *The Forward Look 1999: Government-funded Science, Engineering & Technology*. CM 4363. The Stationery Office Ltd: London.

18 November 1999

APPENDIX 8

Memorandum submitted by the Biotechnology and Biological Sciences Research Council

EXECUTIVE SUMMARY

1. The BBSRC sponsors eight Research Institutes which represent a major element of the Science Base underpinning the agriculture, food and environmental industries. The funding for these institutes is drawn from a range of sources; overall the BBSRC's strategic grant accounts for 36 per cent of total funding, and MAFF and other government departments account for 28 per cent. Over the past 15 years, the decline in MAFF and other departmental funding has put major pressure on the BBSRC's Science Vote to meet redundancy and other costs.

2. While OST's role is to advise departments on the implications of the use of their R&D budgets, the long-term health of the Science Base underpinning these industries is not considered to be the responsibility of MAFF or other departments. Thus, the strategic requirements of these sectors for scientific research are not generally the subject of a common position despite the very significant proportion of total funding provided by MAFF and other departments.

3. The 1999 Forward Look is a very useful and accessible document but provides little synoptic view of government's R&D priorities and how they are being met through the various streams of science funding.

1. INTRODUCTION

1.1 The BBSRC was established by Royal Charter in 1994 and is funded principally through the Science Budget of the Office of Science and Technology within the Department of Trade and Industry. The mission of the BBSRC is:

- to promote and support high-quality basic, strategic and applied research and related postgraduate training relating to the understanding and exploitation of biological systems;
- to advance knowledge and technology, and provide trained scientists and engineers, which meet the needs of users and beneficiaries (including the agriculture, bioprocessing, chemical, food, healthcare, pharmaceutical and other biotechnological related industries), thereby contributing to the economic competitiveness of the United Kingdom and the quality of life;
- to provide advice, disseminate knowledge, and promote public understanding in the fields of biotechnology and the biological sciences.

1.2 BBSRC's total planned income in 1999–2000 is £200 million. Of this sum, the Council plans to spend £62.2 million in its eight sponsored Research Institutes. These institutes represent a significant element of the Science Base supported by the Council. The key features of the institutes are set out in the Council's Operating Plan (para 2.18); they are:

- distinctive and focused research missions;
- strategic and multidisciplinary research orientation with a longer-term perspective;
- user community input through membership of governing bodies and advisory groups;
- an emphasis on knowledge/technology transfer: IP, know-how, public good information;
- special research facilities eg disease containment, animal houses, glasshouses.

BBSRC's main institute funding is through the Competitive Strategic Grant (CSG) and associated capital infrastructure grants. Institutes also have access to other general funding mechanisms, such as research

initiatives, responsive research programmes (RRPs), ROPAs, LINK, an institute JREI scheme and studentships. Funding from these mechanisms amounted to approximately £10 million in 1998–99.

1.3 The Table below shows that 24 per cent of Institute income in 1999–2000 will come from MAFF and 3 per cent from other government departments. For five institutes, MAFF alone accounts for more than a quarter of total research income. The other principal interfaces are with DFID, DETR and DH.

Institute Funding Mix—1999 to 2000

<i>Institute</i>	<i>Estimated Income £M</i>	<i>BBSRC CSG⁽¹⁾ %</i>	<i>BBSRC Other Funding %</i>	<i>MAFF %</i>	<i>Other Govt Depts %</i>	<i>Industrial Contract Income %</i>	<i>Other Res Income inc Charities %</i>	<i>EU/ Overseas %</i>	<i>Other Sources %</i>
BI	14.5	62	3	2	6	5	5	1	15
IAH	25.8	25	9	37	5	4	0	3	16
IACR	25.9	34	8	26	2	15	0	9	7
IFR	14.0	58	6	14	1	5	0	13	3
IGER	14.5	25	3	48	1	11	0	2	11
JIC	20.8	49	9	7	4	6	5	12	8
RI	11.6	25	9	34	1	14	0	5	11
SRI	9.9	29	6	27	7	19	0	2	10
total/ sector %	£137.0M	38%	8%	24%	3%	10%	1%	6%	10%
1998–99 Comparatives*	£132.6M	36%	7%	24%	4%	10%	2%	7%	10%

⁽¹⁾ Includes Capital Equipment Allocations and Minor Works

* 1998–99 CSG figures have been reduced by £3.8M to show equivalent funding for employer pension contributions.

2. TRENDS IN THE SCIENCE BUDGET AND DEPARTMENTAL EXPENDITURE

2.1 The Committee will have seen the trend data in Chapter 2 (Table 2) of the 1999 Forward Look. These show a steady and very welcome increase in the real value of the Science Budget over the period 1997–98 to 2001–02. There is a parallel real terms increase in the total Science Base expenditure line.

2.2 The departmental real terms data show a long-term trend of decline in the MAFF budget from £253 million in 1986–87 to £127 million in 2001–02. Of the other departments which interface with BBSRC, DETR research expenditure is broadly stable while DFID and DH show a small decline. BBSRC also interfaces directly with the Scottish Executive which funds five research institutes in Scotland that are in the food and agricultural area. Real funding for these institutes is expected to decline slightly.

2.3 The decline in MAFF research expenditure has placed serious pressures on the BBSRC's science budget income over the past decade and a half. Following the 1972 White Paper "A Framework for Government Research and Development" (Cmnd 5046), £19 million was transferred from the then Agricultural Research Council to MAFF as the "customer department". This sum would be worth around £90 million in 1999 prices, while MAFF research spending within the BBSRC institutes currently runs at just over £30 million.

The gap between these figures represents a loss of funding broadly equivalent to the total Science budget expenditure on institute-based research in 1999–2000. The decline has caused the Council to reduce employment in the institutes from 5,750 in 1982 to 3,400 in 1999.

2.4 Over that period, there have been some 1,800 compulsory redundancies and 700 voluntary redundancies, funding for which has predominantly had to be found from within the AFRC/BBSRC Science Vote. This represents a very significant loss to science.

3. THE ROLE OF THE OST IN ADVISING ON R & D EXPENDITURE AND CO-ORDINATING R & D ACTIVITIES

3.1 The Chief Scientific Adviser sets out the OST role in providing advice to government in Chapter 1 of the *Forward Look*:

- OST advises Ministers in the way in which science is used in and by government to maximise the benefit of the government's expenditure to the UK as a whole.
- It is for each department to determine how they should use the resources allocated to them in support of their objectives; OST advises on the wider implications of these decisions.
- OST supports the Council for Science and Technology in reviewing departmental SET activity.
- OST is working with the Treasury and other Government Departments to develop information on the outcomes of expenditure on SET.

- OST facilitates the sharing of good practice, especially in the way science is used to support policy decisions (the “May guidelines”).
- OST co-ordinates advice on handling issues which fall within the remit of more than one department (eg, antibiotic resistance, biotechnology, GM foods).

3.2 BBSRC is not aware of the ways in which OST advises MAFF, DETR and DH on the wider implications of its decisions on R & D expenditure, nor of the extent to which that advice is followed. Nevertheless, it is worth emphasising that MAFF, which is a major funder of research in the BBSRC institutes, has made it clear that it does not consider itself to have a responsibility for maintaining the health of the Science Base. It aims to use its R & D funding to ensure that policy making is informed by high quality research and development, and not to maintain a strategic programme. This is a different stance from that established in the 1972 White Paper which gave MAFF a joint responsibility with ARC for the long-term health of the science base underpinning the food and agriculture industries.

3.3 At the day-to-day level, relationships between BBSRC and the MAFF Chief Scientists Group and Research Policy Co-ordination Division are cordial. The MAFF Chief Scientist sits on the BBSRC Council and BBSRC Office staff and Institute scientists interact very frequently with MAFF in the review and commissioning process for research. The Council and MAFF have a Concordat which provides a framework for regular meetings to exchange information and views. There is however no formal system for co-ordinating patterns of research funding, and it cannot be said that, with the very significant exception of TSE research, there is a common approach to strategic requirements to maintain key scientific capacity/expertise. Last year, for example, MAFF conducted a comprehensive internal review of key facilities and expertise needed for the long-term health of their science advisory structure. BBSRC institute facilities were not included in that review despite the fact that IAH, IGER, Roslin and IACR all provide sources of knowledge and facilities which are either unique or nearly so. In the spirit of “joined-up” government it would be sensible if MAFF and BBSRC could identify key facilities and unique science expertise within the BBSRC institutes and agree a stable approach to funding. The UK’s strategic capacity in key areas of science supporting the agriculture and food industries ought not to be endangered through short-term fluctuations in funding.

3.4 BBSRC appreciates the problems which face MAFF with a declining research budget and changing priorities from policy makers. However, frequent changes in priorities place BBSRC and its institutes in a difficult financial situation. The research that the institutes provide relies on highly skilled individuals and teams who build up their expertise over a period of years. If MAFF funding for an area of work ends, BBSRC does not have the financial flexibility to support it from other sources. Changes in Departmental funding have had a major impact on the character of the research institutes involving a substantial growth of short-term contract employment of scientists: 80 per cent of institute postdoctoral scientists are on temporary contracts. Examples of changes in the balance of research include the secular decline in endemic disease research at IAH, and in research on cattle and avian welfare at Roslin. The general reduction in funding, linked with changes in the areas of priority, has placed a continuous redundancy burden on the science budget.

4. CONTENT, FORMAT AND TIMING OF THE GOVERNMENT’S FORWARD LOOK

4.1 As a whole, the 1999 Forward Look is an improvement on previous years in that entries for each organisation are more concise and it is easier to identify apparently key activities. However, preparation of the input is very constrained and, certainly in BBSRC’s case, the final version gives a somewhat distorted picture of the Council’s role and programme. While there is clear guidance on the number of words to be used in each section, there is little editorial guidance or control of content. Some entries for Chairman’s/Ministerial statements mainly repeat mission statements, some identify scientific objectives, and some concentrate on managerial and administrative priorities.

4.2 More consistent guidance on content, together with an overall limit on the number of words would be preferable. The emphasis should be on scientific priorities, setting out how departments/RCs intend to spend their allocations, with administrative aspects included only when significant changes are planned. Overall, it is not easy to gain a synoptic view of how the government’s R&D money is used by research area or of how priorities are determined.

4.3 Publication of the Forward Look on the web is a significant improvement in providing statistical information to the public. The web version makes good use of links to the SET statistics for those wishing to delve more deeply into the details. It would be desirable for the publication of the Forward Look to coincide with the SET statistics.

4.4 The overall timing should be linked with major spending announcements and allocations. The 1999 Forward Look rightly concentrates on arrangements following the CSR and its precise timing allowed Departments/RCs some time to make strategic decision. This is sufficient for such a document, particularly with web publication linked to home pages, where more detailed planning can be reported and updated by contributing organisations. It would be sensible to publish the next Forward Look in 2001, following the outcome of SR 2000.

APPENDIX 9

Letter to the Clerk of the Committee from Ms Diana Garnham, Chief Executive, the Association of Medical Research Charities

The Association of Medical Research Charities welcomes this opportunity to make a few very general points to the Inquiry.

AMRC considers that with regard to Government Expenditure on Research and Development there is a need for Government and government departments to:

- acknowledge that where Government is not the only or principal funder of areas or types of research it must work in consultation with other funders for the good of UK science;
- to maintain the focus of the *Forward Look* on the role of research and development in improving quality of life as well as in wealth creation;
- to work constructively, perhaps through specific fora with other funders and users of research, to tackle shared concerns (eg, careers and manpower, research capacity and public confidence in science);
- to improve the quality of published data on UK-wide research and development. Current reports are poor with regard to information on non-government research funding, and thus tend to minimise the impact of not-for-profit funders. Improved quality of information on UK-wide research activity would provide a better context for decision-making;
- to maintain a UK-wide perspective on research and development.

26 November 1999

APPENDIX 10

Letter to the Clerk of the Committee from Professor Peter Lachmann, President, the Academy of Medical Sciences

The Academy of Medical Sciences would like to comment on the research and development spending in the Department of Health where the interests of the Research and Development Directorate are closely similar to the Academy's own interests, in particular in promoting the translation of basic science into clinical practice.

The R&D Directorate in the Department of Health spends approximately £360 million per year in Budget 1 which is distributed to the NHS Trusts throughout the country. Much of this money is not therefore available for any important new initiatives that become available. There are just a further £70 million per year available centrally. It seems to the Academy of Medical Sciences that these central funds are of great importance to the improvement of standards within the National Health Service and to the exploitation of new research knowledge for the benefit of patients. We feel that there is a good case for examining closely the uses to which Budget 1 is put and for asking whether there is room to re-allocate some of this large sum to the central R&D budget.

Although the total R&D budget is roughly 1 per cent of the NHS spend, the disposable budget is a great deal less. In its evidence on the post of Director of R&D last year, the Academy attached high importance to the Director's having an adequate disposable budget to be able to bring to fruition the vitally important goals of his Directorate—and the Academy would like to reiterate and reinforce this view. It seems to us that there is, at the present time, an enormous opportunity to exploit the very rapid progress being made in so many medical fields for clinical purposes. This need can be met effectively only if there is adequate financial support from within the Departments of Health for the necessary R&D.

25 November 1999

APPENDIX 11

Memorandum submitted by the Association of the British Pharmaceutical Industry

The Association of the British Pharmaceutical Industry brings together companies in Britain producing prescription medicines, whether branded or generic, other organisations involved in pharmaceutical research and development and those with an interest in the pharmaceutical industry operating in the UK. ABPI member companies manufacture and supply more than 90 per cent of the medicines prescribed through the National Health Services and are major exporters to countries all over the world.

SUMMARY

1. The recent Comprehensive Spending Review provided for an increase in spending on the UK Science Base and made a start in restoring its underpinning infrastructure. The UK pharmaceutical industry believes that this very welcome initiative must be maintained to allow the UK to maintain and strengthen its international position as a Centre of Excellence for scientific research.

2. The resource provided by Charities and in particular the Wellcome Trust is of immense value to the UK Science Base, but Government should not see such support limiting its own provision of effective infrastructure support.

3. There is no indication that the Office of Science and Technology (OST) can influence Departmental spending on R&D although it does comment on science matters which have broad implications. Arguably, discussions on policy and funding should be linked.

4. The interests of the Association of the British Pharmaceutical Industry are served by its sponsor, the Department of Health, but also the Department of Trade and Industry and the department for Education and Employment as well as the OST itself. The Association believes cross-departmental interactions with the industry should be encouraged and that OST has a major role to play in this.

5. The Government's Forward Look and the R&D Scoreboard are valuable resources in understanding the Government's strategic direction and its perception by the industrial community. More informal discussion on the linkage between these two ends of the Science Base spectrum and options for change would complement formal processes and be very beneficial.

GENERAL POINTS

1. Government funding of the Science Base is vitally important to the competitiveness of the national economy and to the development and implementation of Government policies.

The pharmaceutical industry is research-based and makes major contributions to the UK Science Base in a variety of ways. These include job opportunities in well-found facilities, support for the educational base and a major positive contribution to the UK Balance of Payments. These two research streams are complementary and support the Government's wider policy of creating prosperity through public-private partnerships.

2. The support of the Charities in maintenance and growth of the Science Base has been significant over the last few years. In particular, the Wellcome Trust has been instrumental in helping Government address major infrastructure issues in the Science Base, part funding the Joint Infrastructure Fund and underpinning major initiatives such as the Human Genome Project and potentially the new synchrotron. The Government must ensure that this support does not allow it to abrogate its own responsibilities in providing adequate resource. The recent result of the Comprehensive Spending Review is excellent but must not be seen as a "one-off" but rather as the beginning of a major reversal of the last two decades decline in the quality of our infrastructure support for science. This decline is probably more severe than had been supposed as the recent survey by the CVCP (supported by other assessments) showed.

3. The NHS spending on R&D is expected to be £390 million in 1998–99 and will be maintained at about this level over the next three years. This support, along with the Research Council and Funding Council funding for the Science Base in the health related area is substantial and is spread across four Government Departments. There appear to be few mechanisms for formal discussion of policy, strategies and implementation programmes between the departments and particularly with their industrial sectors which cross departmental boundaries. These mechanisms should be increased and strengthened, particularly with more informal discussion groups, if the UK is to maximise the benefit of its currently strong position.

4. The Pharmaceutical Industry is strongly multidisciplinary, particularly in R&D and conducts much cutting edge science in what would be seen as "applied science" areas such as pharmaceutical formulation, chemical and biotechnology engineering and analytical science. Support for these disciplines in academia is an opportunity which the Research and Funding Councils have recognised but could exploit more fully. The OST has a major role to play in identifying these areas and ensuring cross-Departmental programmes are created and well managed.

5. Reporting of SET activities is to be commended and encouraged. The Government's Forward Look is a valuable and appreciated resource and must be maintained, although its previous form of a larger volume with an executive summary would be preferable. The more extensive data sets and more detailed coverage of Departmental future plans were valuable. The R&D scoreboard is valuable but is still not comprehensive in the pharmaceutical sector at least and this reduces its value.

6. There is a trend within the pharmaceutical industry towards more partnerships between companies of all sizes and with academia in both research and development. The OST should be encouraged in its work with Departments and Industry to see if more directed support could facilitate and grow this trend.

APPENDIX 12

Memorandum submitted by Society for General Microbiology

INTRODUCTION

The Society for General Microbiology (SGM) with over 5,000 members is the largest professional body for microbiologists in Europe and second only to its US counterpart in the world. Membership is drawn from universities, research institutes, industry and most areas of education. Much of current development in genetic manipulation, biotechnology and molecular biology is based on microbial technologies and as such the SGM contributes substantially to research and development in the UK.

The SGM would like to submit the comments listed below for consideration.

1. There is a limit to how much scientific research can be planned. However, the development and application of scientific advances can be dealt with at policy level and OST has a clear role in this process.

2. The Government needs advice based on good science. Good policy must rest on good science. The role of SEAC in the development of BSE policy is good evidence of this point. (Professor Sir John Pattinson and Professor Jeff Almond are both members of SGM). Learned Societies do have an important part in this process and the interfaces with ministers should be developed further.

3. The UK and Europe needs to keep at the forefront of emerging technologies, DNA chip technology, for example. In this respect it is extremely disappointing that the EU is withdrawing support from the European Bioinformatics Institute. This will affect 40 institutions and we should put pressure on the EU to continue support.

4. The increasing complexity of scientific disciplines requires an acceleration of investment to allow the proper teaching of advanced technologies. This affects both secondary and tertiary education. It may appear as the perennial complaint but universities are continuing the process of teaching more students without the corresponding rise in funding. Inevitably the quality of the laboratory teaching is compromised and high quality research universities are where high quality scientists are trained.

5. Please also note the submission by the Institute of Biology of which the SGM is an Affiliated Society.

29 November 1999

APPENDIX 13

Memorandum submitted by The Royal Academy of Engineering

The Royal Academy of Engineering comprises the United Kingdom's most eminent engineers of all disciplines. The Academy's objectives may be summarised as the pursuit, encouragement and maintenance of excellence in the whole field of engineering to promote the advancement of the science, art and practice of engineering for the benefit of the public. The Academy aims to take advantage of the wealth of engineering knowledge and experience that its Fellows possess. The interdisciplinary character of The Academy's membership provides a unique breadth of expertise with which to further all forms of engineering.

By promoting a multi-disciplinary approach, The Academy is able to overcome traditional barriers and to demonstrate the interdependence of different areas of expertise in the efficient use of modern technology and engineering. Emphasis is also placed on the importance of well-informed communication between engineers, Government, research establishments, industry, public services and academia.

The evidence which follows represents a collation of personal views from Fellows of The Royal Academy of Engineering. It cannot reflect the views of all contributing Fellows nor those of The Academy as a whole.

1. THE LEVELS OF SPENDING ACROSS GOVERNMENT ON RESEARCH AND DEVELOPMENT AND THE USE THAT IS MADE OF DEPARTMENTAL RESEARCH AND DEVELOPMENT BUDGETS IN TERMS OF ADDRESSING FORESIGHT PRIORITIES AND MINISTERIAL OBJECTIVES

Foresight Priorities

1.1 Concerning the extent to which research and developments address Foresight Priorities, Fellows of The Academy report that success appears to be mixed. In some research areas Foresight can be seen to be influencing the distribution of funding and enabling a better dialogue between government, industry and academia. In others—for example, those under the auspices of the Ministry for Agriculture, Fisheries and Food (MAFF)—Fellows see little evidence that Government department spending on R&D has been changed as a result of Foresight. Less than transparent decision-making processes make the reasons for this apparent lack of Foresight recognition unclear. This is unfortunate, as an important objective of the Forward Look was to make funding mechanisms more “explicit and open”.

1.2 Particularly with regard to MAFF, research budgets appear to be at risk of further decline. Fellows note that policymakers now view research as a vehicle for the support of Government department policy, instead of as a source of new knowledge and a means of creating social and economic benefits. The lack of influence of the Office of Science and Technology over MAFF, and an observed disbelief in the relevance of scientific and technological research to government policy is held to be a real cause for concern. It is difficult to see how strategic Agriculture, Fisheries and Food activities in the UK are well served by a lack of influence of scientific research on the policy decisions made in departments such as MAFF.

1.3 It has been suggested that closer communication between the Office of Science and Technology, the Department of Trade and Industry and other Government Departments might be assisted by more integrated thinking on the launch and arrangement of research and development initiatives. Initiatives such as the Defence and Aerospace Foresight initiative and the National Advisory Committees and Defence and Aerospace Research Partnerships (DARPs) have greatly assisted the process of developing and implementing Foresight Priorities. These initiatives should be maintained into the second round of Foresight and the survival of such partnerships might be made more likely by the availability of dedicated funding.

1.4 Foresight is not just a set of techniques designed to develop technological priorities. It is a process which aims to encourage communication between people from different backgrounds, to generate new ideas, collaborative partnerships, shared understanding and commitment. Fellows note that such public-private partnerships in engineering research are an important part of the Foresight process, and that the Forward Look does not function as a guide to what is happening in this area.

1.5 In general, Foresight is welcomed as part of a balanced research portfolio that also supports and stimulates high-quality, curiosity-driven research. Foresight is seen as playing a major role in bringing social and economic benefits to the UK. The need to consider the impact of engineering research on society is recognised in the forthcoming Royal Academy of Engineering document, "Measuring Excellence in Engineering Research".

Ministerial Objectives

1.6 Fellows believe that the meeting of ministerial objectives in science and technology is currently being undermined by the existing shortfall in human resources in science, engineering and technology. A number of factors are causing an erosion of the UK's high-quality science, engineering and technology (SET) base, including: (i) the downturn in young people studying science and engineering related subjects in schools, (ii) the falling number of university applicants in almost every area of science and engineering (bar the biosciences) (iii) the low esteem and salaries of SET school teachers and university staff and (iv) the deteriorating infrastructure in engineering departments.

1.7 These are problems that will not disappear of their own accord. To address ministerial objectives and to maintain the science and engineering base, urgent and adequate attention and action needs to address the negative factors outlined above. The UK needs to know more about why young people choose not to study science and engineering subjects at school and why young students decide to drop sciences before or after their "A" levels. Similarly, more information is needed about why students choose not to study science and engineering at university and what factors make the biosciences the exception to the rule. It is also important to discover why science and engineering graduates drop out of science and engineering after their degrees. Fellows suggest that one reason for this loss of engineering talent is the low stipends that are awarded to research students and research staff at Universities. These make it difficult to recruit high quality people in competition with commercial salaries.

1.8 The effect of low esteem and low salaries on SET schoolteachers and SET university staff may also need further examination. Most importantly, steps need to be taken to help refurbish the infrastructure of engineering departments in universities. The funds available through the JIF scheme within EPSRC seem to be far too small to do this.

1.9 Several organisations, learned societies and institutions are trying to tackle this major problem. It appears that, to date such activities have been carried out in an uncoordinated, underfunded, sub-critical way. Fellows note that other countries are experiencing similar problems, albeit on a smaller scale. Overcoming these difficulties ahead of its rivals may be a source of competitive advantage for the UK.

2. THE TRENDS IN SCIENCE BUDGET AND DEPARTMENTAL EXPENDITURE ON RESEARCH AND DEVELOPMENT IN THE CONTEXT OF TRENDS IN INDUSTRIAL RESEARCH AND DEVELOPMENT AS DEMONSTRATED IN THE R&D SCOREBOARD

2.1 Fellows note that although levels of spending in the Office of Science and Technology have been maintained over recent years, the spending on science, engineering and technology by other government departments—once 80 per cent of the total SET spend—has been quietly but considerably reduced.

2.2 The industrial research context is particularly relevant to Departmental R&D spending. As industrial interests lean more towards short-to-medium term applied research, it is important that Departments support work that complement these; longer-term strategic and underpinning research. For example, the R&D budget of MAFF was originally used for underpinning research and included some excellent strategic

research related to agriculture and food. This has now changed; MAFF now spends a considerable proportion of its funds on very applied work and surveys.

2.3 It is noted that shortfalls in strategic or “underpinning” research in science and engineering have an impact on the UK economy, for example, in the protection of public safety or the environment. It is to these areas that MAFF has had to switch its funding recently. An increased emphasis on applied work and surveys means that the amount of government spend on true R&D has decreased even further than the figures suggest.

2.4 Fellows also note the problem of re-location of R&D in globalised companies. Large aerospace manufacturers, for example, appear to be moving R&D offshore to benefit from the financial support available to large-scale technology programs in Europe and the US. It is suggested that more funding from the UK would help to alleviate this problem. This is especially important as Aerospace is a significant source of wealth creation in the UK—as demonstrated by the licences and launch aid repayments that currently contribute to Department of Trade and Industry funds.

3. THE ROLE OF THE OFFICE OF SCIENCE AND TECHNOLOGY (OST) ON ADVISING ON DEPARTMENTAL DECISIONS ON RESEARCH AND DEVELOPMENT EXPENDITURE

3.1 Fellows would like to see closer links between government departments on the launch and arrangement of research and development initiatives, and a greater influence of the Office of Science and Technology on the policies and R&D activities of departments across the board.

3.2 Some top-level policymakers do not believe that SET research has ever influenced government policy. In such departments the attitude is adopted that scientific and engineering research exists only to support Government policies. A more enlightened approach would acknowledge the role of such research to help guide Government policy. The UK has already experienced the negative consequences of political processes that deny the importance and relevance of research.

3.3 Foresight has been identified as creating the dialogues that are useful for knowledge exchange. It is suggested that the Royal Academy of Engineering’s forthcoming review, “Measuring Excellence in Engineering Research” might form a useful platform for discussion to bring together policymakers in the OST, DTI and other departments with similar interests.

4. THE OFFICE OF SCIENCE AND TECHNOLOGY’S ROLE IN CO-ORDINATING SUCH ACTIVITIES

4.1 There seems to be little co-ordination between Government Departments on R&D spending. Schemes appear to be hastily put together in an ad hoc manner. Fellows express doubt that the Office of Science and Technology has any influence over MAFF R&D decisions. There is no evidence that the OST even accepts that it has a role in the co-ordination of such activities. It is considered that if this state of affairs continues, science budgets will continue to shrink.

4.2 Fellows suggest that an initiative should be set up to establish a better gearing across sectors. This would involve a serious cross-department examination of activities. A similar holistic approach is necessary to address the effects of the increasing interdisciplinary nature of engineering research, which currently highlights deficiencies in the overall Research Council structure. Better use could therefore be made of existing levels of spending by ensuring there are no gaps or duplication in the activities of the Biotechnology and Biological Sciences Research Council (BBSRC), the Economic and Social Research Council (ESRC), the Council for the Central Laboratory of the Research Councils (CCLRC), the Medical Research Council (MRC), the Natural Environment Research Council (NERC), the Particle Physics and Astronomy Research Council (PPARC) and the Engineering and Physical Sciences Research Council (EPSRC), all of which fund engineering activities. It is very important that economic and social issues are incorporated into science and engineering research. This is necessary to translate excellent science and engineering research into economic and social benefit.

4.3 Due consideration of the need to create a level playing field between the HEIs and research institutes should also be made. It is noted that Government department R&D budgets have been opened to HEIs to bid, but research institutes are not allowed to compete with HEIs for responsive mode funds.

5. THE MEANS BY WHICH SUCH ACTIVITIES ARE REPORTED, INCLUDING A REVIEW OF THE CONTENT, FORMAT AND TIMING OF THE GOVERNMENT’S FORWARD LOOK

5.1 It is believed that whilst the format of the report has been improved by making it more compact, it might now be a little too brief. However, the Forward Look was created to give a horizontal look at science and technology by using a common format. By reporting on programmes separately, it is difficult to extract meaningful information about levels of spending across Government on research and development. This would appear to defeat the original objective of the document.

5.2 From an engineering perspective, outcomes are more important than inputs. It is suggested that the Forward Look might also discuss past successes and potential future successes. A discussion of public-private partnerships might also be of interest to those in many areas of science and engineering. Knowledge

transfer—collaborative involvement—is a characteristic of research excellence that is relevant to all the departments that report in the Forward Look. It is suggested that an increased interest in knowledge transfer would be welcomed, and might be reflected in the Forward Look by a cross-departmental examination of strategies and mechanisms to transfer knowledge. Some Fellows have commented that internationally, the UK needs to engage in more academic exchange schemes outside the EU; for example, in the US and the Far East. A scheme to encourage one-on-one laboratory partnerships would be welcomed.

5.3 Excellent engineering research requires a culture of innovation to be engendered during the education process. It needs skills at both the technician and engineer level to provide the capabilities needed by different interest groups in industry, for example, IT, communication, maths and business knowledge, with discipline to sustain the engineering base. The Forward Look needs to set out the Government's strategy for encouraging excellence in this area, and to solve the human resource problems outlined in para. 1.7. Some Fellows have argued that without academics that are skilled in risk assessment, schemes like Enterprise Challenge would benefit from the involvement of entrepreneurs with some experience of risk-taking. Another concern is that the means through which objectives are to be met—for example, spin-off company targets—are not always made clear by the Forward Look.

5.4 In general, it is considered that levels of spending across Government should be directed to bring maximum social and economic benefit. The Royal Academy of Engineering has itself carried out a review of the research excellence characteristics that impact on society through social and economic benefits. Fellows suggest that this document might have a useful role in the future development of the Forward Look, in addition to other areas of research policy.

26 November 1999

APPENDIX 14

Letter to the Clerk of the Committee from Dr David Falvey, Director, the British Geological Survey

The British Geological Survey (BGS) was established in 1835. It is the longest-established geological survey and is one of the oldest scientific institutions in the World. It is now part of the Natural Environment Research Council (NERC), from where it delivers both a "public good", and a commissioned programme of strategic geoscientific research, surveying and monitoring. The BGS now serves UK Government, Industry and communities by providing knowledge-based services, which:

- support safe, sustainable and efficient choices for managing environmental risks and hazards, and for using land, petroleum, mineral and groundwater resources;
- support service delivery with acquisition of new geoscience information; and
- enhance the UK science base, through Programmes of public information, education and training.

If general advice is sought by Government on scientific issues, the BGS may be contacted directly by the OST or through the NERC. However, many departments (and their associated agencies) come directly to the BGS scientists, including Professor J A Plant, sit on various Government panels such as that for sustainability indices, and provide input to the decision making and advisory process based on their experience gained through the Science Budget and commercial projects.

In the context of rising public concerns over environmental futures, plus an expanding regulatory framework aimed at public protection, the Science Budget allocated to the BGS for strategic research, survey and monitoring, has been in slow decline (in real terms) over many years. Of the 15 geological surveys that exist in each of the EU member countries, the BGS is one of the worst funded (on a GDP per capita basis). With a large slice of the Science Budget allocated to basic surveying and monitoring (to meet legitimate public good priorities, as determined by the BGS Board), little flexibility remains to meet new priorities. Thus:

- Radwaste research and development in the BGS virtually ceased when NIREX withdrew funding allowing the collapse of the Sellafield public enquiry.
- Radon gas is the second biggest cause of cancer in the UK and has a unique geological origin. The risks associated with radon gas can be mitigated through knowledge of its location. The BGS's work to show the distribution of the risk of radon gas occurrence in the UK is done for the DETR directly and receives only £50K per year. This work feeds into health policy and building regulations in areas at risk.
- Research into the underground disposal of Carbon Dioxide relates to Foresight sustainability issues and energy use as well as climate change, etc. This is industrial research with almost no Science Budget funding input. The research is funded by the EU and the DTI at £100K per year over the next two years (there is no long-term commitment).
- Research performed for the Environmental Agency for the DETR aimed at resource protection and Quality of Life issues includes research into:
 - microbiological contamination of groundwater at a cost of £50K per year;
 - cryptosporidium in groundwater at £30K per year; and
 - land quality and contaminated land at £90K per year.

Most departmental research and development funds are spent on relatively short-term research (months to two or three years) in support of the immediate needs of policy development. In part, this is because policy development takes place over these time scales. However, some aspects of research, that are relevant to policy development, can only yield results over much longer time periods (decades). An example of this might be the response of the ground in terms of land stability, to long-term changes in climate, particularly changes in the amount and intensity of rainfall. Another example is the long-term consequences of reduction of groundwater pumping in former coal fields and in urban areas where industrial usage of groundwater has declined. Such long-term monitoring, with its associated data management and interpretation, is essential if the effects of natural environmental changes and the effects of the interaction of man with that environment are to be anticipated and planned for.

Another critical problem associated with Government departmental policies of "short-termism" is the development and retention of appropriately expert staff. It might be argued that long-term monitoring is the responsibility of the Research Councils. However, over many years, the Research Councils have tended to favour "pure" science, rather than "applied" science, in the belief that the "user" will pay for the latter. So far, the "user" in general, and Government departments, in particular, have been reluctant to pay for such long-term monitoring, despite the importance of the information. Both the OST and client Departments have a role to play in ensuring that the long terms needs of the country for strategic environmental information are met, perhaps by better collaboration and a strategic dialogue between the Departments and the Research Councils.

30 November 1999

APPENDIX 15

Memorandum submitted by the Royal Pharmaceutical Society of Great Britain

THE ROYAL PHARMACEUTICAL SOCIETY OF GREAT BRITAIN

The Royal Pharmaceutical Society (RPSGB) is incorporated by Royal Charter as the registration and professional body for pharmacists in Great Britain in all aspects of the practice of the profession, the promotion of pharmaceutical education and the application of pharmaceutical knowledge. Here, the Society is concerned with science in general and pharmaceutical sciences in particular. The Society welcomes the opportunity to respond to the invitation of the House of Commons Select Committee for Science and Technology to provide evidence on the Government's expenditure on research and development: Forward Look 1999.

SUMMARY

1. The recent Comprehensive Spending Review provided for an increase in spending on the UK Science Base and made a start in restoring its underpinning infrastructure. This very welcome initiative must be maintained to allow the UK to maintain and strengthen its international position as a Centre of Excellence for scientific research.

2. There is no indication that the Office of Science and Technology (OST) can influence Departmental spending on R&D although it does comment on science matters, which have broad implications. Arguably, discussions on policy and funding should be linked. RPSGB believes that there should be Policy integration between the Department of Health and the Research and Funding councils which could be facilitated by the Office of Science and Technology.

3. The pharmaceutical sciences, which underpin much of the research within the pharmaceutical industry, are often seen as applied rather than fundamental. The Society believes that this is rather a measure of their interdisciplinary, particularly at the biology/chemistry and at the materials interfaces and that this character is of great value to the UK Science Base. The OST is the natural advocate to encourage the links between the Department of Health, the Research and the Funding councils in this area of science.

4. The Government's Forward Look and the R&D Scoreboard are valuable resources in understanding the Government's strategic direction, the implementation of Policy and its perception by the industrial community. More informal discussion on the linkage between these two parts of the Science Base spectrum and then on options for development and change would complement existing formal processes and be very beneficial.

GENERAL POINTS

1. Government funding of the Science Base is vitally important to the competitiveness of the National economy and to the development and implementation of Government Policies. The pharmaceutical sciences are research based and make major contributions to the UK Science Base through the pharmaceutical industry and through academic research. The pharmaceutical industry is a major positive contributor to the

Balance of Payments in the UK and the education and training of its future research staff is of paramount importance.

2. The Government must ensure that this support is maintained and, in fact increased as there has been under-provision of well-found research facilities for many years, as documented in a variety of surveys, in particular that of the Committee of Vice Chancellors and Principals (CVCP) in 1998. The recent result of the CSR is excellent but must not be seen as a “one off” exercise. It should be the beginning of a major reversal of the last two decades decline in the quality of the infrastructure support for science.

3. The NHS spending on R&D is expected to be £390 million in 1998–99 and will be maintained at about this level over the next three years. This support, along with the Research Council and Funding Council funding for the Science Base in the health related area is substantial and is spread across four Government Departments. There are few mechanisms for formal discussion of Policy, strategies and implementation programmes between the departments and particularly with their industrial sectors which cross Departmental boundaries. These mechanisms should be increased and strengthened, particularly with more informal discussion groups if the UK is to maximise the benefit of its currently strong position.

4. The pharmaceutical sciences are strongly multidisciplinary and contribute much cutting edge science in what would be seen as “applied science” areas such as pharmaceutical formulation, chemical and biotechnology engineering and analytical science. Support for these disciplines in academia is an opportunity which the Research and funding Councils have recognised but could exploit more fully. The OST has a major role to play in identifying these areas and ensuring cross-Departmental programmes are created and well managed.

5. The Society is launching an initiative early in 2000 called “The Scientist in the High Street” which will seek to provide patients with advice on health related matters including an interpretation of the modern fields of genomics and pharmacogenomics. Awareness of active R&D activity in the health care sector including, in many cases participation in it, provides one of the few opportunities to bring new science to the general public and pharmacists are ideally placed to do this.

6. Reporting of SET activities is to be commended and encouraged. The Government’s Forward Look is valuable and must be maintained although its previous form of a larger volume with an executive summary would be preferable. The more extensive data sets and more detailed coverage of Departmental future plans was valuable. The R&D Scoreboard is valuable but is still not comprehensive in the pharmaceutical sector at least and this reduces its value.

7. Should the Committee require further information please contact Dr J Clements, RPSGB, 1 Lambeth High Street, London SE1 7JN.

1 December 1999

APPENDIX 16

Letter to the Clerk of the Committee from Professor Ian Halliday, Chief Executive, Particle Physics and Astronomy Research Council

PPARC is the UK’s strategic science investment agency, delivering world leading science, technology and people. It spends around £200 million per annum, on research and training in astronomy, particle physics and space science. It provides national and international facilities for use by UK scientists and supports individual researchers in UK universities. It pays the Government subscriptions to the European Laboratory for Particle Physics research (CERN) and the Science Programme for the European Space Agency (ESA).

PPARC welcomes this Enquiry by the Select Committee, and notes that it includes consideration of trends in the Science Budget (and departmental expenditure on R&D) in the context of trends of industrial R&D, and the role of the OST.

THE BALANCE OF FUNDING

We warmly welcomed the major increase in the Science Budget, which the Government secured last year. This will be important in underpinning the national economy and we very much hope that that increase will be sustained, and if possible further enhanced.

PPARC notes that the major focus of that increase was on the promise of the life sciences, in particular genomics, and that the underpinning physical sciences did not receive the same level of increase. Specifically PPARC was the only Research Council to receive only a very modest increase in real terms, and received provision for the Government’s subscriptions to CERN and ESA (Science Programme) with no compensation for future inflation.

The genomics programme in particular and the life sciences in general undoubtedly hold out the prospect of substantial economic return. But we would point out that the contribution to the economy and the future prospects of the physics-based industries, in particular in IT and communications, have the potential to make a much larger contribution. We note that the Director General for Research Councils, Dr John Taylor, made this point to the Committee last year.

The most far-reaching impacts on society and economy this century came from developments in basic physics, which could never have been dreamt of by those doing the original research out of pure curiosity. I refer of course to electricity (from Faraday), radio (originally from Maxwell), electronics (from Thompson) and nuclear power (Rutherford). Most recently the World Wide Web is impacting on our lives faster and to an extent unimaginable to the physicists in CERN who wrote the key software that enabled it to take off.

No-one today would dare forecast what benefits may come from understanding why all matter has mass (the Higgs Boson question), or why the universe contains matter at all, or whether there is life on Mars or other planets. But given these examples of how basic physics has revolutionised our lives this century, it would be a brave assertion to say that there will be none in the next century.

The implication is clear. If we want the UK to stand a chance of benefiting from the next generation of fundamental advances of this sort, in an increasingly sophisticated and competitive world, our scientists and engineers must be kept at the international cutting edge.

THE ROLE OF OST

There are two ways in which the role of OST could be valuably enhanced.

Given the importance of harnessing the advances in science to the benefit of society, there is the potential for OST to play a stronger role in overseeing and co-ordinating the research activities of other Government Departments.

Secondly, given the long-term nature of major research projects, in particular large international research facilities, we believe that it is important for OST to take a long-term strategic view of the UK's needs for, and potential contributions to, major research infrastructure, in a European and wider international context.

I would be pleased to expand on these points to the Committee in oral evidence.

2 December 1999

APPENDIX 17

Memorandum submitted by Silsoe Research Institute

INTRODUCTION

1. Silsoe Research Institute is one of the eight research institutes grant-aided by the Biotechnology and Biological Sciences Research Council. Our mission is to meet the needs of the agri-food industries through excellence in engineering science and innovation. Our major disciplines are engineering, physics and mathematics and our particular expertise is in applying these at the interface with biology. We have a range of customers, including BBSRC, MAFF and industry, and a successful record of technology transfer into our customer industries.

2. We believe that SRI's role is to maintain balanced programmes of engineering research with co-ordinated Science Budget, Government and industry funding. In this way, both Government and industry can be sure that there is scientific expertise and innovation underpinning the strategic and applied work they are paying for, and ready to help with new problems as they arise.

SUMMARY

3. Engineering disciplines are an essential component if we are to realise the potential for advances in science and technology to benefit the biology-based industries. This has been recognised throughout the Technology Foresight programme. Historically MAFF have supported this as an integral part of their R&D programme. Recent pressures on departmental funding have led to dramatic reductions particularly in the commissioned programme which had supported strategic capabilities in engineering and physical sciences. Funding won from MAFF through open competition and LINK has grown, but the disproportionate reduction in engineering commissions (compared to other science areas) threatens our ability to sustain skills essential to long term needs of MAFF or other government departments, and to the benefit of the UK.

THE STRUCTURE OF ENGINEERING RESEARCH FOR THE FOOD CHAIN

4. We have been successful in supporting the agri-food industry by taking our high quality science and innovation, funded by BBSRC and MAFF, through to wealth creation. Our engineering systems studies also provide the understanding of how farming and rural systems can be sustainable, both economically and environmentally. However, to achieve successful technology transfer from Government funded research, there are several prerequisites:

4.1 an appropriate balance of basic and strategic research, so that the quality of our applied work for industry customers is supported by sound scientific expertise as well as a knowledge of the customer's needs;

4.2 stable long-term support for our research teams, essential because of the long timescales required for technology transfer. A 5–10 year period is normally required for innovative research to be transferred to the market (Annex A);

4.3 long-term relationships with our industry customers, including industry organisations which fund research, such as levy boards as well as commercial companies.

4.4 strong collaborations with other research organisations, both public sector and independent.

FUNDING FOR THIS RESEARCH

5. Our balanced portfolio of research is achieved through three categories of funding:

BBSRC Competitive Strategic Grant

5.1 This funds international quality basic and strategic research to underpin science areas that will be important to our customer industries over the next 10 years. For example, our Advanced Engineering programme includes robotics for handling food products, image-based sensors and biosensors for monitoring plants and animals, and autonomous vehicles for plant scale husbandry. Our Fluid Dynamics programme includes research on the dispersion and deposition of particulates, such as spray droplets, and micro organisms in food factories. Our Modelling and Optimisation programme includes mathematical modelling of agricultural processes subject to uncertainty for use in decision support systems, and the interpretation of spatial variability in soil data within a field, to provide a basis for precision agriculture.

5.2 The BBSRC have recognised the importance of engineering science to the delivery of their remit, and this component of funding has increased progressively since 1990.

MAFF Commissions, Open Contracts and LINK projects

5.3 Our relations with MAFF in specific scientific and policy areas are strong and positive, and our broad relevance to many sectors of the industry brings us into contact with many individuals. However, the absence of any champion for engineering in MAFF limits the scope for a strategic view.

5.4 Increasingly MAFF is moving away from commissioning strategic research, to funding short term projects through competitive contracts lasting two-to-three years, and LINK schemes where the research is done with industry partners. At the same time, MAFF's priorities are becoming more focused; the Forward Look 1999 refers to research to inform and underpin policy aims and objectives, and these are now focused on public health and protection of the environment, and on other areas of public concern such as animal welfare and GMOs. Engineering and physical sciences are important skills in understanding and delivering these benefits. However, it is all too easy to regard these skills as secondary to biological concerns, or more downstream.

5.5 In this context engineering research has suffered disproportionately. MAFF is now generally unable to sustain strategic funding for topics such as advanced engineering or precision agriculture which have the potential to transform the efficiency and sustainability of the agri-food industries, but require generic pre-competitive research to bring them to the point of transfer to industry funding.

Industry

5.6 Our industry and levy body funding is very important to us and has grown substantially. These contracts give us excellent links with our user industries but they rely on the existence of the expertise and experience built up through our CSG and MAFF funded strategic research.

THE CONTRIBUTION OF FORESIGHT TO SRI'S PROGRAMME

6. We welcomed the prominence given to engineering and physical sciences in the generic priorities identified by the original Technology Foresight Steering Group. We believe this reinforced our role within BBSRC; we emphasise the need for an engineering contribution if innovations in biology are to be put into practice. We have unique specialist expertise in using advanced engineering and information technology in an agri-food context. We have used Foresight conclusions to inform our allocation of BBSRC CSG funding to projects at SRI.

7. We have since noted the importance attached to a strong science base to support the UK agriculture industry by Professor John Marsh (1997)¹ in his review of the role of agriculture, horticulture and forestry in the UK economy. We have also noted numerous engineering-related priorities identified in the 1998 reports of the Agriculture, Horticulture and Forestry Foresight Panel and the Natural Resources and Environment

¹ Marsh JS (1997) A review of the role of agriculture, horticulture v forestry in the UK economy. A discussion document by the AHF Foresight Panel Office of Science & Technology, Department of Trade & Industry URN 97/521.

Panel. These include, in the AHF–Crop Production report, specific reference to the importance of agricultural engineering and information technology for effective and sustainable production by providing, eg targeting of crop protection, decision support to optimise inputs, and sensors for monitoring and diagnosis. The AHF Livestock Production report identifies animal housing environments and husbandry systems as of continuing importance in promoting animal health and welfare. It also recommends a systems approach to examine the interactions between production factors on health, the presence of pathogenic organisms, and environmental impact. Engineering research has an important role in such an approach.

8. The Natural Resources and Environment reports seldom refer directly to agriculture, but their conclusions should clearly inform MAFF's priorities. They include reference to cleaner processes and products, use of IT and control, life cycle analysis, and improved technology for environmental monitoring.

9. The Foresight process has given context for future research needs, and this has influenced the BBSRC's engineering research for its sector. It is important that this should be part of a coherent strategy, taking account of Foresight, across the R & D of other Government Departments.

3 December 1999

APPENDIX 18

Memorandum submitted by the Royal Society of Edinburgh

1. The Royal Society of Edinburgh is pleased to respond to the Select Committee's request for comments on the Forward Look 1999 in connection with its Inquiry into Government's Expenditure on Research and Development. The RSE is Scotland's premier learned society, comprising Fellows elected on the basis of their distinction, from the full range of academic disciplines, and from industry, commerce and the professions.

2. In considering the levels of spending across Government, it is important to recognise that devolution has changed the patterns of political responsibility for regional components of the research and development (R&D) base and should enable regional priorities to be articulated.

3. The specific areas of consideration are addressed below:

THE LEVELS OF SPENDING ACROSS GOVERNMENT ON RESEARCH AND DEVELOPMENT AND THE USE THAT IS MADE OF DEPARTMENTAL RESEARCH AND DEVELOPMENT BUDGETS, BOTH IN TERMS OF ADDRESSING FORESIGHT PRIORITIES AND MINISTERIAL OBJECTIVES

4. Basic research is the bedrock on which the ability of the R&D base to address immediate and long-term needs rests. It must be characterised by focus in areas of research opportunity and need, and diversity which gives flexibility to address new opportunities. The infrastructure costs of modern science are very large, and it would be prohibitively expensive even in a relatively substantial economy like that of the UK to maintain a world-class capability across all fields. Decision on the levels of spending across Government, therefore, have to be made about investment priorities. While intellectual curiosity will always be a driving stimulus to science, an R&D base, which paid no regard to the needs of the economy and society generally, would be an unaffordable luxury. Driving the R&D base to address problems based on need alone, without heed to their tractability, is also a recipe for waste. Priorities should therefore be set in areas where there is a conjunction of tractability and need. However, although investment choices must be made, they must not lead to over-specialisation which reduces the capacity to exploit unexpected innovations. The key to retaining the flexibility to exploit such opportunities lies in maintaining a broad capability in basic science which continuously re-synthesises specific knowledge in the form of general understanding with broad applicability.

5. While it might seem attractive only to maintain applied R&D capabilities which directly underpin current needs, this is not a viable option. In setting priorities and objectives it needs to be recognised that the technologies which underlie most daily life (medical care, natural resource use and environmental protection) are increasingly driven by scientific innovation. The time taken to pull innovation in basic science through into application in new technologies appears to be getting shorter, producing shorter-term interdependence of basic, strategic and applied research. Basic research will continue to be the engine of strategic and applied research in developing new technologies, and must be maintained if only to support them. Moreover, knowledge developed elsewhere, which may create new technologies, is not automatically made available to another country. Effort and deep understanding are needed to acquire such knowledge and harness it to domestic needs. A national capacity to absorb foreign knowledge requires a domestic capacity to perform research at a high, internationally competitive level. A productive and robust modern economy cannot depend largely upon scientific output from elsewhere.

THE TRENDS IN SCIENCE BUDGET AND DEPARTMENTAL EXPENDITURE ON RESEARCH AND DEVELOPMENT IN THE CONTEXT OF TRENDS IN INDUSTRIAL RESEARCH AND DEVELOPMENT AS DEMONSTRATED IN THE R&D SCOREBOARD

6. A strong “pull” from users is the best means of ensuring that the R&D base is effectively exploited. It is important to be aware of the needs of users, and for users to be aware of the potential of the R&D base. This applies to the outputs from all the streams of knowledge and expertise in supporting and promoting industrial and economic development, in supporting government policies in health, education, environment, etc, and in providing advice to legislators and citizens.

7. At present, Scottish industry suffers from very low levels of investment in research and development. For instance, the multinational companies that dominate one of the most important of its industrial sectors, the information and communications industry, have hitherto undertaken virtually no research, design or even development work in Scotland, limiting interaction with universities to the provision of trained manpower. As a consequence, industry cannot pull through or exploit science base innovation as effectively as in other economies with a more mature industrial base.

8. Strong interaction is crucial in linking strategic and applied research to its industrial application. The success of Japanese industry in marketing new technology through the 1980s is believed to reflect their capacity to mobilise two-way flows of information between R&D and production divisions in vertically integrated company structures. Steps should be taken to ensure that the many routes by which the public purse funds the R&D base and its exploitation are managed in such a way as to maximise opportunities for efficient vertical integration, and that public/private partnerships are facilitated. The recent White Paper on competitiveness emphasised the importance of regional partnerships between the SET base, industry and statutory agencies. For these to be effective, there must be mutual understanding of the objectives and strategies of partners in the region, and they must be aware of national and European policies and opportunities. It is also important to create an environment which encourages entrepreneurial attitudes, and which is able to provide finance to support those who see opportunities for the development of innovative technologies.

9. The point along the basic-applied research spectrum at which public funding is replaced by private funding is a key policy issue. A helpful model of the role of public sector intervention is provided by recent developments in the microelectronics industry in Scotland. Microelectronic manufacturing, largely by inwardly investing companies, has become a major industrial sector in Scotland. It has not however included a significant R&D capability, and has not been able either to respond to technological change (unless the overseas parent companies decide to implement innovations in Scotland) or to interact with the R&D base. During the last two years, a US company, Cadence, decided, because of the excellence of microelectronics and computer science research in Scotland, to invest in a significant R&D capability in Scotland, and to link its development with training and research within the universities. It is now hoped that other companies will do likewise as part of the Scottish Enterprise Project Alba, and that home-grown service companies will develop to broaden R&D based activity and pull more strongly on the R&D base. This hoped for pattern of closely knit activity involving different types of companies, the R&D base and government agencies, is the essence of the Scottish Enterprise “cluster strategy”. The challenge now is to create analogous development in other areas such as biotechnology, biomedicine, wider dimensions of information technology, optoelectronics, chemistry, etc.

THE ROLE OF THE OFFICE OF SCIENCE AND TECHNOLOGY (OST) IN ADVISING ON DEPARTMENTAL DECISIONS ON RESEARCH AND DEVELOPMENT EXPENDITURE

10. Many modern science based issues have proved politically intractable because scientific information is inevitably incomplete on any single issue at a given time, and because Governments have found it difficult to come to terms with scientific uncertainty, both in formulating policy and in communicating it to the public. The OST needs to address the over-compartmentalisation between government departments and between scientific disciplines. The lack of co-ordination across the wider R&D base will tend to frustrate an effective, integrated use of the R&D base in policy formulation. In addition, the OST needs to inform civil servants and politicians that “science” rarely produces complete answers to a given problem, and can only assist in a helpful manner by defining problems more clearly and evaluating risk.

OST’S ROLE IN CO-ORDINATING SUCH ACTIVITIES

11. It is important that devolution does not lead to fragmentation of basic research in the UK, and that basic R&D in Scotland remains well integrated within the UK system as part of an evolving European R&D base. It is also important that the Research Councils, which are reserved UK institutions in the Scotland Act, continue to operate within their UK-wide remit effectively and that Scotland continues to compete UK-wide for R&D funding.

12. Scotland, however, has an opportunity to develop distinctive solutions to the management of its R&D base. With a population similar in size to Denmark and Norway, it will be fortunate in having an R&D base which is an integral part of the larger, world class, UK R&D base. Application of the principle of subsidiarity,

in which decisions and actions are taken at the level at which they can be most effective, will be vital to the successful operation of the R&D base in a devolved Scotland.

13. At the Scottish level, this devolved responsibility facilitates:

- greater support from the R&D base for issues that are specific to the region in health, education, agriculture, fisheries and the environment;
- promoting wealth creation and the quality of life through greater co-ordination and shared strategies between key players (universities, colleges, research institutes, enterprise companies, industry, finance and government) in ways such as those proposed in the recent Scottish Office report *Scotland: Toward the Knowledge Economy*; and through enhanced investment in R&D intensive industry;
- a better reflection of public values in Scotland in the creation of public policy in such areas as the environment (eg issues such as Brent Spar, genetically modified crops, wind and nuclear energy or hydroelectric schemes) involving innovative methods of public consultation and participation;
- support of policy formulation and scrutiny by the new Parliament and executive, though better advisory arrangements to provide that support effectively are likely to be needed.

14. At the UK level, the Scottish SET base must remain an integral part of the UK system of basic research. Its scale benefits Scotland and the other regions of the UK by stimulating international competitiveness, through the inherent flexibility of a large system to adapt to change whilst focusing major efforts in areas of current need and the capacity to attract and retain scientists of international calibre. Realising these objectives will require enhanced co-ordination both within Scotland and with the rest of the UK, and the OST should ensure that financial and organisational barriers to full integration in the UK R&D base are minimised or removed.

15. The Research Councils, which are a reserved UK function and which should remain so, and the devolved Higher Education Funding Councils should recognise their important roles in maintaining the UK SET base. At the same time, devolved powers can be a basis for more effective application of the SET base through the creation of regional alliances, as advocated in the 1998 White Paper on Building the Knowledge Driven Economy. The means whereby these latter objectives are attained will vary from region to region, depending upon the nature of devolved responsibilities. It is important that, as constitutional arrangements become more complex, means of co-ordination of the UK SET base appropriate to the new arrangements are developed; and this will be a key role for the OST.

ADDITIONAL INFORMATION

In responding to this inquiry the Society would like to draw attention to the following Royal Society of Edinburgh publications which are of relevance to this subject: *The Scientific Advisory System* (June 1998); *Devolution and Science* (April 1999) and *Science and Society* (June 1999). Copies of this response and the above publications are available from the Research Officer, Dr Marc Rands (email: mrands@rse.org.uk).

6 December 1999

APPENDIX 19

Memorandum submitted by The Royal Society

INTRODUCTION

The Royal Society welcomes the opportunity to submit evidence to the Select Committee's inquiry into "Government's expenditure on research and development: Forward Look 1999". The inquiry is at an early stage: we hope that our comments will help to clarify some key issues. This response has been endorsed by the Council of the Royal Society.

Our statistical comments are based on an analysis of the data presented in *SET Statistics 1999: A handbook of science, engineering & technology indicators*.

ANNUAL PUBLICATION OF SET STATISTICS

The annual series of SET statistics has grown in range and value since its first publication in 1984, and now provides a common foundation for much discussion about national policy for science. We are grateful for the work that goes into this important and complex task.

Because the publication is so widely used, it is of course essential that the data be as accurate as possible and that explanations be provided for real or apparent discrepancies—such as the different values given for "indicative UK contribution to the EU R&D budget" in tables 2.1 and 3.1, or the different figures for total expenditure given in table 5.1 and the accompanying narrative in paragraph 5.2.

EXPENDITURE TRENDS

It is not a straightforward matter to judge the health of the national R&D enterprise from broad expenditure statistics. One needs to look at long-term trends. For example, the grand total for Government expenditure on R&D in real terms (table 3.2) is planned to grow by nearly 10 per cent between 1998–99 and 2001–02, but in the latter year will still be 3.4 per cent less than it was in 1986–87—largely because of a 52 per cent cut in spending by civil Departments (excluding the NHS) over this period. One needs to look at balances: the important 14.4 per cent real terms increase in Science Budget R&D between 1998–99 and 2001–02 following the Comprehensive Spending Review is matched by a similar increase in Funding Council budgets, thus preserving the existing balance of the dual support system (to which the Society attached great significance). The 12.4 per cent real terms increase in defence R&D between 1998–99 and 2001–02, on the other hand, is made up of a 16.6 per cent cut in research and a 22.6 per cent increase in development; but such a shift could in principle be a deliberate response to a new set of priorities within MoD.

One of the most striking trends highlighted in the published statistics is the continuing decline in gross R&D expenditure as a proportion of GDP, from 2.22 per cent in 1986 to 1.80 per cent in 1997 (table 6.3). The Government attributes this to the rapid growth in GDP (paragraph 6.2), but this is unconvincing: GDP in this period has grown even more quickly in every other G7 country. The UK spends less of its GDP on R&D than all G7 countries save Canada and Italy (table 7.1, shown graphically below). It may be that the UK achieves better value for money from its spend than do other countries (though it is not immediately evident why this should be so). Nevertheless, this decline has occurred over a period when Government expenditure has decreased in real terms (table 6.3), and this must be a matter of serious concern to both Government and the private sector.

Another significant trend is the steady decline in the proportion of UK R&D that is funded by Government, from 35.4 per cent in 1988 to 30.8 per cent in 1997 (table 7.1). This figure is lower than for any G7 country except Japan (and there the figure has risen from 16 per cent in 1991 to 21 per cent in 1995). It is not evident that such a policy is in the interest of the UK.

DEPARTMENTAL R&D EXPENDITURE

One main focus of the inquiry appears to be R&D spend in support of Departmental policy, ie spend by Departments such as MAFF, DETR (formerly DOE and DOT) and DTI. We mentioned earlier the precipitous decline in R&D spend by civil Departments generally. In 2001–02, MAFF R&D spend is planned to be 34 per cent less than the 1986–87 spend in real terms and DTI spend is planned to be 66 per cent less than the combined DTI and DEn spend (Energy merged with Industry in 1992). DETR, on the other hand, plans to spend about the same in real terms as had the antecedent Departments of Environment and Transport. MoD spend will be 17 per cent down on the 1986–87 figure, despite a significant increase planned over the next three years.

Without examining in detail the R&D policies of each Department, it is impossible to judge how far these expenditure trends reflect Foresight priorities or Ministerial objectives, let alone whether they are in the best interests of the UK. But the net outcome of these individual decisions, coupled with the investment decisions made in the industrial sector, is that the UK is now spending only 1.80 per cent of its GDP on R&D; and this, we believe, is too low for a country trying to compete globally in a knowledge-driven economy.

OST CO-ORDINATION

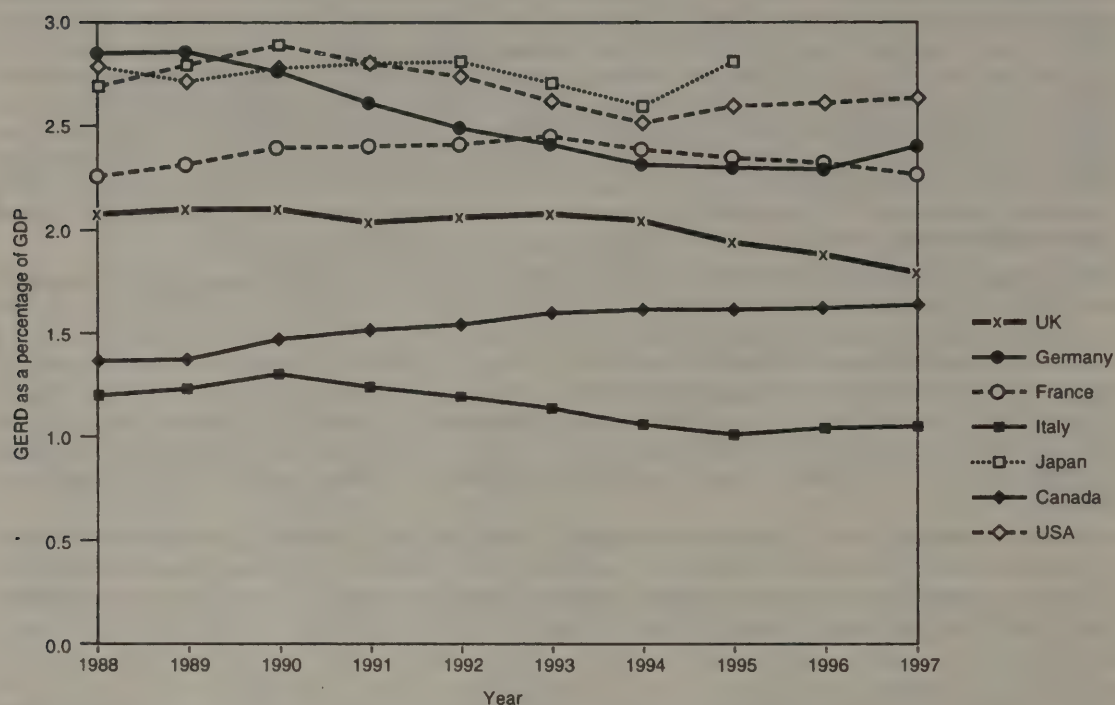
OST has a pivotal role in advising on Departmental R&D spend and in coordinating such spend across Whitehall.

The bald statistics of course tell nothing of the difficulties facing OST in this role or of OST's success in overcoming them. We believe that OST has achieved significant progress with these roles in recent years, for example in setting in place coordinating machinery at Ministerial and at official levels. We note with interest the establishment, just announced, of a new Chief Scientific Advisor's Committee, which will among other things provide collective advice to Ministers through the Ministerial Science Group. It is clear that the new Committee, like its predecessor, will face major challenges in improving the handling of issues that affect several Departments.

There are well known arguments for associating R&D budgets for specific purposes (health, agriculture, environment etc) with the Departments charged with overall responsibility for those purposes. Equally familiar are the reasons why such a policy, coupled with traditional Whitehall territoriality, makes it difficult to deliver a single, coherent approach to Government expenditure on R&D as a whole. This has been exacerbated in recent years by the practice of relying on "internal markets" within each Department to drive the use of departmental R&D budgets; it has become all the harder to influence these budgets from the outside.

Within each spending Department there needs to be a strong group defending the R&D budget and using it effectively. This must be coupled with a strong voice for R&D at Cabinet level.

Table 7.1
Trends in gross domestic expenditure on R&D (GERD) in G7 countries



Source: Table 7.1 SET Statistics 1999: A handbook of science, engineering & technology indicators

APPENDIX 20

Supplementary memorandum submitted by the Association of Medical Research Charities

I wondered whether it would be appropriate for AMRC to add a further point to its submission of evidence on the above enquiry? Arising from a discussion at a recent Council meeting I have been asked to inform the Inquiry of the AMRC's strong support for dual support funding for HEI research. AMRC believes that this mechanism enables universities to make and support longer term decisions about research capacity and infrastructure that could not be funded adequately on short-term external grants.

5 January 2000

APPENDIX 21

Letter to the Chairman of the Committee from Dr Peter Cotgreave, the Save British Science Society, following the Evidence Session of 2 February

When the Professor Peter Saunders and I appeared before the Select Committee on Science and Technology last week, I undertook to write to you regarding a question from Mrs Curtis-Thomas.

The question was whether or not the Save British Science Society had written to the Office of Science and Technology or the Department of Trade and Industry about our potential criticisms of the reporting of statistics in the *Forward Look 1999*, as we set them out in paragraph 46 of our written evidence to your inquiry.

Having now checked the files, I am able to report that we have not written to any of the relevant officials or Ministers about this issue.

Please do not hesitate to contact me if there is any further assistance that SBS can give your committee in the conduct of your inquiry.

8 February 2000

APPENDIX 22

Memorandum submitted by The Ministry of Defence

1. This note has been prepared in response to the request from the House of Commons Science and Technology Committee for a memorandum on MOD arrangements for defence research and development.

2. MOD has a research budget known internally as the Research Building Block (RBB) and published in Estimates and Appropriation Accounts as "major customers' research budgets". Its two major categories are the Applied Research Programme (ARP) and the Corporate Research Programme (CRP). The CRP and ARP both draw on a range of technologies. The ARP is directed at developing solutions for specific military needs and assisting the formulation of operational requirements for future military capability and equipment. About £325 million (net of VAT) was spent on the ARP in 1998–99. The CRP, costing about £120 million in 1998–99, consists partly of research with clear military potential but without, as yet, a defined military need. This is known as the inventive research programme and accounts for about a third of the CRP and a tenth of the RBB as a whole. The rest of the CRP is research aimed at meeting a multiplicity of known military needs as with, for example, research on aluminium corrosion supporting the design of Eurofighter and the in service support of most other aircraft and also some ships and vehicles.

3. Other than the ARP and CRP, the remaining areas in the RBB are international research collaboration, on which £8 million was spent in 1998–99 on funding new collaborative opportunities; the Joint Grants Scheme (that is, joint with research councils), amounting to £5 million; and the European Transonic Wind Tunnel, which represented under £1 million. For forward planning purposes, the RBB also includes up to £40 million of funding for the Technology Demonstrator programme, which is intended to reduce areas of high technical risk associated with the known requirements for future equipment by establishing design options.

4. Over the past three years, defence research has fallen in real terms. This was illustrated in evidence to the House of Commons Defence Committee, published with their ninth report 1998–99. A similar picture is shown in a subsequent Parliamentary answer (Official Report 28 January, col 379) giving Appropriation Account figures of cash expenditure, excluding technology demonstrator programmes. Future planned allocations have not been issued but, as said in evidence to the Defence Committee, it is likely that expenditure will fall somewhat over the next few years. This trend is also reflected in *Forward Look*, although the *Forward Look* data is based on statistical rather than budgetary categorisations of expenditure and is not, therefore, directly comparable with Appropriation account figures. It nevertheless illustrates a likely reduction to a level some 10 per cent lower than now.

5. This trend reflects the continuing search for value for money. It is considered that the reduction in research output over the last 10 years has been considerably smaller than the reduction in funding. The planned Public Private Partnership for the Defence Evaluation Research Agency (DERA) will bring further improvements in value for money from research, both in terms of the quality of the output and the cost. This will build upon DERA's considerable record of achievement since its formation as the Defence Research Agency (DRA) in 1991.

6. Research for MoD is largely managed by DERA, with the greater part also conducted by DERA. A proportion, currently about £20 million is being put out to direct competition and we intend to develop our use of competition as a means of improving value for money in research in light of this pilot scheme. Also, the new approach of concentrating on developing specific areas of technological excellence will maximise the potential benefits from funds available (see paragraph 13 below).

7. Development expenditure is a separate matter. There is no defence R&D budget—there is a budget for research as described above, and another for equipment procurement. Within the expenditure on procurement, some may be regarded as development and some as production but this distinction, although

shown in published statistics, is not used for budgetary or programme management purposes. The overall level of equipment development expenditure in any one year is primarily driven by the position of major equipment projects in the procurement cycle. This is the factor behind the apparent rise in development expenditure shown in Forward Look. It does not reflect a decision to increase development expenditure at the expense of other areas of the defence budget. Details of MoD expenditure on equipment projects are published in the Comptroller and Auditor General's annual Major Project Report to Parliament.

8. Decisions on budgets are made annually, on how much of the resources available to defence over the coming years should be spent on each area within the defence budget. In this process, forward plans and their costs for each area are reviewed and then collated together (at successively higher levels of aggregation) so that judgements can be made on any adjustments necessary in order to maximise total defence output. Among the many different budgetary areas are equipment procurement, and research (excluding development).

9. Regarding allocations within the research area, the process is mainly as follows. Starting from the missions, tasks and specific military capabilities required of the Armed Forces, desired improvements are identified. For example, new equipment might be needed to respond to shortfalls against an emerging threat, or to improve force affordability in whole life cost terms. If research is needed in order to deliver the required capability, it is identified and posed to the research supplier, normally DERA, as a package. DERA respond with a proposed programme of research work to address the requirements of each package. Subject to endorsement by the MoD customer for the research in question, and to affordability, the programme of work is then set in hand. The discussions between customer and supplier on each proposed research package also take account of wider factors, such as the need to facilitate collaboration and research planning with industry, other Government departments and allies, and also wealth creation, contributing to the UK's overall prosperity.

10. Some research, mainly in the Corporate Research Programme, arises not from the process described above, but through ongoing research effort in areas with military potential but without a defined military need. This is particularly a feature of the inventive part of the CRP. Inventive research necessarily involves an element of speculation, but potentially high payoff in terms of the battlewinning edge of the future.

11. Allocation of funding between research programmes is, in the first instance, a matter for the budget holders concerned—the Deputy Chief of Defence Staff (Equipment Capability), DCDS(EC), for the ARP, and the Deputy Under Secretary (Science and Technology), DUS(S&T) for the CRP and the smaller areas such as the Joint Grants Scheme. However, the overall structure and balance of MoD research programmes is reviewed annually by the Defence Research Committee, DRC, chaired by the MoD Chief Scientific Adviser (CSA). Also, the allocation of funding to research, with particular attention to the balance between research and other calls on the defence budget is also reviewed annually as part of the Department's overall planning and costing process referred to above.

12. With regard to liaison with other Government departments, there are specific bilateral arrangements with DTI for funding aeronautical research work on dual use technologies. There is also dialogue between MoD and the research councils, notably the Engineering and Physical Sciences Research Council (EPSRC) and the Medical Research Council (MRC). In addition, MoD is a member of many interdepartmental groups or working committees on matters concerned with science, research, technology, equipment or industrial matters. The MoD is also included on the interdepartmental Chief Scientific Adviser's Committee, chaired by Sir Bob May and referred to in the Office of Science & Technology's memorandum.

13. The Government's Foresight programme is also an important factor. Foresight priorities are taken into account in devising relevant research programmes to meet defence requirements. MoD involvement in Foresight, which relates mainly to the Defence and Aerospace and Systems Panel (DASP), enhances the visibility of defence technologies which might have wider applications. DASP has also contributed to discussion on, for example, defence diversification and the future of DERA. In addition, the UK defence industries have been working within the Government's Foresight initiative to produce a National Defence Industry Technology Strategy. Taken together with MoD's existing technology strategy, the intention is to produce a joint national strategy to identify areas in which technological excellence might best be concentrated and defence-specific technologies enhanced to the level required to produce world class equipment. The joint strategy will thus inform MoD research planning (within available resources). It will enable MoD to be selective in a rational way about the research undertaken, and to make the necessary choices in partnership with industry.

28 February 2000

APPENDIX 23

Letter to the Clerk of the Committee from the Save British Science Society

Thank you for your letter of 15 February, following our oral evidence session on 2 February.

In answer to the first of your questions, the graph on page (v), covered in our oral evidence, was the main concern we had about the presentation of information in the Forward Look document. I think it would be unfair if we were to make other criticisms suggesting that any of the information in the document was misleading.

The main answer to your second question is that it would be useful to have some indication of how actual performance measured up against the plan set out in previous editions of the Forward Look. A table showing whether departments invested less or more than they said they were going to would be extremely interesting. In addition, we think it would be very useful for the Government to produce more comprehensive lists of the projects that are funded through the departmental R&D budgets. It may not be practical to list them all in the Forward Look, but perhaps there could be a web page with all the information, accessible through the OST's website.

Lastly, we think it would be useful if some standard format could be found to provide some indication of how effectively each department is measuring up against the Chief Scientific Adviser's guidelines on the use of scientific advice in government. I know there is a fuller annual review of the implementation of those guidelines, but a small box for each department, describing progress, in the Forward Look would give a slightly more complete picture of government performance in the area of R&D. It might also set targets for how implementation of the guidelines could be improved, year on year.

I hope this information is of use to the Committee, and I look forward to reading their report when it is published.

23 February 2000

APPENDIX 24

Letter to the Chairman of the Committee from the Rt Hon Nick Brown MP, Minister of Agriculture, Fisheries and Food

RESEARCH AND DEVELOPMENT: THE FORWARD LOOK 1999

Thank you for your letter of 16 February. I am grateful for the opportunity to contribute to your Committee's current inquiry.

MAFF is a strongly science-based Department. It is essential to us to have high quality scientific advice with which to develop, inform and implement our policies and regulatory responsibilities. I take very seriously my Department's role as a funder of research, not only to support our policies, but also to maintain and enhance the UK science base.

Overall MAFF spending on R&D has declined in recent years. I took over the Ministerial reins in MAFF at the end of July 1998, just as the Comprehensive Spending Review (CSR) outcome was being announced. I think it is self-evident that MAFF was subject to a particularly tough settlement. This left us some way short of our needs and it meant that we were forced to make unwelcome cutbacks in a significant number of areas.

However, I would emphasise that the R&D areas of highest priority—all those mentioned in the second paragraph of your letter—have been fully protected from reductions, and increased where necessary, to ensure that our capabilities in these key areas are maintained.

For example, our TSE research programmes have grown from £5.6 million in 1995–96 to over £15 million currently.

As part of the 1998 CSR, a group on MAFF R&D was established to consider the state of the MAFF research programme and to make recommendations for future policy and funding levels. This Group involved MAFF officials, including the Principal Finance Officer and Chief Scientist, together with representatives from the Treasury, the Cabinet Office Efficiency Unit and two senior independent experts (Professor Derek Burke and Professor Sir John Marsh). The Group conducted a comprehensive study of the programme, and endorsed its rationale and balance, and looked at MAFF's commissioning practices. In addition it made several important recommendations, including that:

- (i) research spending be increased by up to £8 million per annum to focus on key areas (food safety, zoonoses and other animal diseases and biotechnology);
- (ii) the LINK programme (involving 50:50 Government/industry/funding of projects) should be expanded to lever greater contributions from industry;
- (iii) the Ministry should consider a funding model to allow core-funding of key scientific facilities, whilst also ensuring appropriate levels of competition within the overall programme to encourage good quality science and value for money;
- (iv) MAFF should introduce external input and greater transparency into its research commissioning and prioritisation procedures; and
- (v) the Ministry should do more to evaluate its research outputs.

The Group's recommendations were accepted in principle. But the funding position within MAFF did not allow for extra resources to be made available to increase our R&D programme spend at that time. Indeed, since R&D is the largest single element of our discretionary programme expenditure, we were left with no

option but to make cuts here. I therefore took the decision to reduce the R&D budget by –£3 million, –£4 million and –£6 million in the CSR years to:

1990–00	2000–01	2001–02
£125.3m	£124.3m	£122.3m

However, I also prioritised our budgets specifically to give continuing protection to those areas of research of highest importance, for example our work on TSEs, bovine TB and aspects of organic farming.

I do share the Committee's concerns about our funding possibilities. These were reflected in a recent report of the Council on Science and Technology to the Prime Minister. Your Committee has also had evidence from Lord Sainsbury and Sir Robert May (16 February Q107 *et seq*) on MAFF budgets and the level of our R&D funding.

Since the CSR, we have been working hard in a number of ways to implement the recommendations of the advisory group to which I have referred. I remain fully committed to ensuring that MAFF policies continue to be underpinned by science, and that we retain the ability to fund strategic research to enable us to take a proactive approach in implementing our policies. I do see a need for increases in our R&D programmes and we are taking steps to achieve that. Specifically I hope to be in a position to expand R&D on TSEs over the next five years. I should be able to make an announcement about this shortly. I shall be seeking additional funds for new R&D programmes in the forthcoming spending review.

In addition:

- (i) my Department is now putting together, and will during 2000 be consulting on and publishing a new MAFF Research Strategy to cover the period 2001–05. I am keen to increase the level of input of our stakeholders in deciding on our future plans for research;
- (ii) I have recently approved plans to open up and modernise the way we prioritise and commission our scientific activities by creating a new MAFF Science Committee. This will have a wider remit to include all our scientific monitoring and surveillance activities as well as R&D; it will include a number of senior and external appointees. To increase transparency about what we do, and to raise the profile of MAFF-funded science, the new Committee will publish minutes of meetings as well as regular reports;
- (iii) greater effort will be made to publish regularly our research requirements, to peer review project proposals, and to disseminate MAFF R&D results and policies, making full use of the internet and other electronic communications;
- (iv) we have already considered ways of ensuring a balanced funding model to allow optimum levels of competition within the programme, whilst also maintaining our key long-term research needs. We will be taking these issues further in discussion with key contractors and other departments;
- (v) we are expanding our programmes of research funded through the LINK process. Over the last two years, expenditure has risen by 80 per cent to £5.9 million;
- (vi) we have established a programme of *ex post* evaluations, conducted by independent consultants, to report on the success and value for money achieved from our research. The first study, on crop molecular genetics, is complete, and the 200–01 programme of evaluations is about to start.

Finally, I should like to offer a comment about another point touched on in your letter to me: the role of the Permanent Secretary, the Chief Scientific Adviser (Sir Robert May) and my own Chief Scientist. In virtually all departments, Chief Scientists report to their Permanent Secretaries. So I do not think it quite right to suggest that the Permanent Secretary in MAFF in some way “interposes” between the Chief Scientist and Chief Scientific Adviser, to the possible detriment of MAFF's science policy. There is an active and healthy debate at all appropriate levels between MAFF and OST. This includes bilateral contacts between Ministers on science policy matters and the work of the Ministerial Science Group on which we are represented. There are regular meetings at Permanent Secretary level (for example on the High Level Committee on Research into TSEs which the Cabinet Secretary chairs). My Chief Scientist and his staff meet Sir Robert and his staff frequently at the regular sessions of the Chief Scientist's Advisory Committee, and in many other fora to discuss various issues such as Foresight, Forward Look, science strategies, the recent report by John Baker on commercialisation of public sector research, the guidelines on scientific advice in policy-making, the development of a new science and innovation strategy and many specific science policy matters—from antibiotics to zoonoses. I believe these arrangements are working well and very productively.

I hope that this additional information goes some way towards reassuring the Committee of my determination to maintain the balance and high quality of MAFF-funded R&D.

2 March 2000

APPENDIX 25

Supplementary memorandum submitted by the Ministry of Agriculture, Fisheries and Food, following the Evidence Session of 2 February

SUPPLEMENTARY QUESTIONS FOR MAFF

QUESTIONS NOT REACHED AT THE MEETING ON 2 FEBRUARY

To what extent does MAFF take into account levels of R&D expenditure in the food and agricultural industries in determining appropriate expenditure levels and priorities for research contributing to industrial competitiveness?

1. The level of funding in support of the various parts of the agriculture and food industries is determined by judgments on a complex mix of factors including the degree of CAP support for a particular industry, the contribution to the wider economy of the sector, the degree to which industry is capable of funding its own R&D, the past history of government support and perceived strategic needs and the role which R&D can play. For example, the horticulture industry receives virtually no CAP support so MAFF's research programme provides important underpinning to the research funded wholly by the industry via the Horticulture Development Council. The cereals industry, which produces products with a similar value to the horticulture industry, receives a lower level of R&D investment, though one which is roughly matched by industry contributions via levy body payments. In contrast, the food industry is supported by a relatively small R&D budget which is devoted almost exclusively to joint funding with industry. The food industry makes a substantial R&D investment, though this tends to be by a few major companies. MAFF R&D funding is in part used to encourage investment in science by smaller businesses.

Examples of the R&D funded in these areas?

2. In concert with the food industry, MAFF has funded the development of models for distribution of airborne contaminants in high care food manufacturing, such as chilled food plants. Using these models, it has been possible to develop novel approaches to localised delivery of chilled and clean air to surround food, thus reducing food contamination, whilst allowing operator access. MAFF supports research to improve the raw material quality of meat and milk produced in the UK, thereby helping the UK industry to maintain a competitive advantage in national and international markets. MAFF is supporting research to develop crop forecasting techniques to facilitate more targeted pesticide applications, thus optimising control whilst minimising pesticide use. In pursuit of environmental and sustainable agriculture goals MAFF is actively supporting the use of genetic marker technology which offers the opportunity of speeding up conventional plant and animal breeding processes.

3. Particular attention has been given to production of biomass and non-food raw materials that can make a cost-effective contribution to national greenhouse gas emission control targets or the production of high value sustainable products. The objective of the research programme is to provide the basis knowledge to aid the development of a competitive sector of the farming industry which can produce these crops, without additional subsidy, whilst protecting the environment and reducing chemical and energy inputs.

4. Agri-industrial crop products comprise a very broad spectrum of materials ranging from solid biofuels from short rotation tree crops to essential oils from herbs. The research base required to underpin development spans the genomic and biochemical basis of productivity and product quality through to economic and environmental analyses of production systems and life-cycles.

5. Details of some recent outputs from this area of the research programme are attached at Annex A.

Objectives for MAFF R&D funding devoted to enhancing industrial competitiveness?

6. The essential justification for Government intervention is determined by "market failure". This is where the market does not provide the private sector with the incentives to support the quality and mix of research that would most benefit society. Government intervention is necessary to achieve these benefits. There may also be a case for Government intervention to ensure the optimum provision of near market research in fragmented industries such as agriculture which do not have the resources to invest in research. Intervention can take the form of ensuring that mechanisms exist for collecting funds for research from all beneficiaries (for example through Levy Bodies), or by direct Government research funding.

7. MAFF's overall Aim is "To ensure that consumers benefit from competitively priced food, produced to high standards of safety, environmental care and animal welfare and from a sustainable, efficient food

chain, and to contribute to the well-being of rural and coastal communities". Under this Aim, MAFF works to 10 separate objectives, one of which relates to industry, as follows:

MAFF Objective 4—"To assist the development of efficient markets in which internationally competitive food, fish and agricultural industries can thrive."

8. Below this objective, each area of research is governed by more detailed policy and scientific objectives setting out why the research is needed and the anticipated benefits. Industry-related research also contributes to strengthening the UK technological base and competitiveness of the food and agriculture industries, in line with general Government objectives to promote employment and investment for sustained economic growth.

How much/what proportion of the R&D budget is directed towards supporting industry? Will the creation of the FSA alter this balance?

9. Currently about £38 million of the MAFF R&D budget of £125 million is classified under the MAFF objective to "assist the development of efficient markets in which internationally competitive food, fish and agricultural industries can thrive". The creation of the Food Standards Agency will result in the diminution of the total R&D budget by about £20 million when R&D funding on food safety matters transfers to the FSA. The absolute value of the funding of work in support of competitiveness will remain unchanged.

10. This research is designed to encourage industry to take a strategic approach and to look for long-term solutions to present day problems. A great deal of this research is identified through the Government's Foresight initiative and much is funded in direct collaboration with industry, through LINK programmes. As well as supporting industry competitiveness, research in this area also promotes sustainable agriculture. Programmes address, for example, the need to research more environmentally benign farming practices with emphasis on lower inputs of fertilisers and pesticides, yet maintaining competitiveness. Many features respond to the EU's Agenda 2000 CAP reforms. Also included is research relating to the protection of animals, fish and plants against disease, some of which relates to statutory requirements and is relevant to MAFF objectives on public health and animal welfare.

Is there a role for MAFF to compensate for under investment in R&D on the part of the food and agricultural industries to maintain and improve industrial competitiveness?

11. There is a role for MAFF to play in addressing market failure in fragmented and financially depressed industries. Funding research caused by market failure often aims to reduce the external costs of production (environmental costs) and provides the pre-competitive strategic knowledge base required for industry's market driven research to build on. Much of the research supported by MAFF and in support of industry also aims to improve food quality or food safety; it should not be forgotten that research to promote food safety is supporting competitiveness every bit as much as research aimed at reducing the costs of production.

REQUESTS FOR NOTES ON SPECIFIC ISSUES

Clarification of RBG Kew R&D funding?

12. MAFF supports the Royal Botanic Gardens, Kew through annual grant-in-aid towards staff costs, other running costs and capital expenditure. In 1999–2000 grant in aid amounted to £16.75 million. MAFF funds this separately from the R&D budget. The figure of £10.6 million on page 6 of Forward Look refers to Kew's expenditure on core R&D in 1998–99 (ie excluding special projects such as the Millennium Seed Bank).

Detailed information on income-generation activities of MAFF's Agencies/NDPBs?

13. MAFF is responsible for three research-based Agencies and two NDPBs. Information on non-MAFF income targets and achievements for each is shown in the following table.

14. Details of the research, monitoring and surveillance work undertaken by the MAFF Agencies, by HRI and RBG (Kew) are available in the published Annual Reports and Corporate Plans of each body.

1 March 2000

Table 1

MAFF Agency/NDPB	1997-98		External Income ¹ 1998-99		Analysis (£k) 1999-00		2000-01	2001-02
	Target	Actual	Target	Actual	Target	Forecast	Target	Target
Central Science Laboratory	3,882	3,534	5,233	4,376	5,922	6,006	11,075	11,845
Centre for Environment, Fisheries & Aquaculture Science	2,462	2,239	3,542	3,706	4,168	4,000	7,508	9,605
Veterinary Laboratories Agency	5,610	5,873	5,800	6,512	5,800	6,950	6,263	6,425
Horticulture Research International (NDPB)	6,490	6,810	7,960	7,400	9,610	8,550	8,810	9,460
Royal Botanic Gardens (NDPB) ²								

¹ Includes all non-MAFF income (both R&D and non-R&D), from the private sector, Levy Bodies, other Government Departments and the EU.

² The Royal Botanic Gardens, Kew also generates commercial income. However, this is primarily intended to support activities other than R&D such as visitor amenities.

Annex A

INDUSTRY-RELATED MAFF-FUNDED RESEARCH: SIGNIFICANT OUTPUTS

ARABLE CROPS AND PESTICIDES

DESSAC

The first process based Decision Support System that spans simulation of fundamental crop processes to economic return. This allows farmers to “grow” the crops in the computer in their own farm situations and ask “what if” questions on crop individual management activities.

Crop Molecular Genetics

MAFF R&D has enabled world class expertise in crop transformation to be established in public research establishments. This will enable UK breeding companies to pursue breeding goals for improved quality and disease resistance characteristics in UK arable crops.

Pesticide Risk Assessment.

MAFF funded R&D has resulted in improved methods of pesticide assessment and registration for PSD, PSD is one of the leading European pesticide registration authorities and is also at the forefront of world discussions in this area.

Does Oilseed Rape cause allergies?

Oilseed rape is a very important arable crop in the UK and its oil is used for cooking in the home and by the food industry. Its levels of saturated fatty acids (thought to contribute to heart disease) are amongst the lowest in the major edible oils. There has, however, been increasing public concern about the links between flowering oilseed rape and asthma and allergic reactions in people living nearby. MAFF (with HGCA) funded a key review of research undertaken to assess whether adverse health effects were associated with this crop. The study concluded that although some individuals may have an allergic response to oilseed rape pollen, the scientific papers examined did not indicate that oilseed rape was responsible for widespread adverse health effects.

Renewable energy

MAFF funded R&D is underpinning the efficient production of biomass energy crops. This will help to meet Government's targets for increased utilisation of renewable sources of energy and reductions in CO₂ emissions.

FOOD TECHNOLOGY

Understanding appetite control

A LINK project has shown how fats and carbohydrates contribute to nutrient intakes and appetite control. The information will enable the food industry to formulate low calorie foods based on scientific principles.

Understanding consumer perceptions of flavour

A LINK project has developed ground breaking methods for measuring the flavour release in foods as eaten and correlating this with consumer perceptions. This enabling technique means that food formulations can be generated with precision, and in hours rather than in weeks.

Understanding the effects of raw material quality on end product quality

LINK projects have investigated aspects of raw material quality in the production of breakfast cereals, potato based products, milk based products, beef and pork, baked goods and beer. This has led to an understanding of key components that need to be present and why, and ways in which they can be measured.

Controlling product quality in the absence of on-line measurements

A LINK project has applied leading edge data analysis techniques to provide predictions of product quality where this cannot be measured directly in the plant. It has been shown that this has enabled corrective action to be taken by process operatives and that, as a result, the quality variability in the end product has been halved.

Controlling product quality and safety in aseptic processing

A LINK project has provided the understanding of process flows and heating regimes in aseptic processing of foods such as cook-in sauces. This has enabled process times to be safely reduced, with consequent reductions in “over-cook” and savings in capital costs.

Controlling product safety in chilled food manufacture

A LINK project has employed advanced modelling techniques to devise systems for maintaining a localised cold and clean environment around food items being manipulated in a process hall which, for health and safety reasons, needs to be at a higher temperature.

Temperature control in chilled food distribution

A LINK project has applied various techniques to model the temperature of chilled foods during distribution. A practical tool has been developed for refrigerated vehicle design, and for day to day planning of delivery schedules.

Controlling product safety in food packaging

A LINK project has demonstrated the feasibility of using laser technology to weld lids onto food containers and to provide a “read out” to show whether seals are complete.

Waste minimisation at the plant design stage

A Teaching Company Scheme has shown that process modelling techniques can be used effectively to identify the amount of waste generated for different food plant configurations and operating regimes. This technique can now be used to design plants that generate less waste.

HORTICULTURE

Improved varieties of fruit and vegetables with enhanced pest and disease resistance.

Pest and disease prediction systems which lead to improved pesticide use.

Seed technology, including seed priming and modelling of seedling establishment leading to increased uniformity of production of vegetable and flower crops.

Diagnostic development including technology transfer from medical arena, eg, use of pregnancy testing kit technology for virus detection in potato crops in the field.

HORIS—IT information package for major horticultural crops.

Widespread use of biological control techniques in protected edible crops and perennial fruit crops and increased use on ornamental crops.

Efficient use of nutrients—reduces leaching.

Crop scheduling—enables growers to maximise market opportunities by producing what the market wants, when it wants it.

Successful HortLINK Programme, encouraging industry investment in R&D.

Outputs from research have led to improved production techniques with increased output per unit area. These increases in efficiency have enabled the industry to remain competitive despite enlargement of the EU and cheaper production in the southern member states.

AGRICULTURAL LINK

Comprehensive guidelines for successful integrated arable farming, resulting in quality produce with reduced inputs and environmental benefits.

Decision support systems for nitrogen management in both arable and horticultural crops.

Patch spraying of weeds in arable crops, with large reductions in quantities of chemicals used.

Techniques for tailoring fertiliser applications to plant requirements, to improve quality and reduce environmental effects (includes canopy management and yield mapping).

Improved transport and handling methods for pigs, resulting in better animal welfare and meat quality.

ANIMAL SCIENCE

Patented methods for the production of clones from adult animals, like DOLLY, enabling more rapid and reliable improvements in genetic potential.

Guidelines on the use of natural feed ingredients to produce meat and milk that contributes to a healthier fat content in the consumers' diet.

Guidelines on the inclusion of legumes into beef diets, allowing cost effective and safe replacement of meat and bone meal in feed.

Recommendations which will enable farmers to reduce deaths in new-born lambs as high as 30 per cent in some flocks.

Provision of scientific data to inform the risk assessment process for GM crops.

Techniques for *in vitro* fertilisation and embryo transfer in sheep which will speed up breed improvement schemes for hill sheep.

New improved varieties of grass and clover enter UK and foreign National and Recommended List every year, allowing higher yielding cattle and sheep to be raised more efficiently in extensive grazing systems.

A patented genetic marker for improved meat quality in pigs is being taken up by UK's world leading pig breeding industry.

A milk test for infertility in dairy cows identifies animals needing treatment, and allows effective therapy.

Selection tools which assist dairy farmers to breed cows for more efficient and higher quality milk production.

Novel engineering developed for robotic milking machines, which are now commercially available.

Computer imaging system developed to measure pig growth in commercial units, now being commercialised.

RESEARCH ON ANIMAL DISEASES

MAFF research on animal diseases maintains the scientific expertise necessary for surveillance of animal diseases and to deal with new and emerging diseases whether imported or as a consequence on changes to recognised conditions.

It is also important in animal welfare terms as it has enabled the more effective control of common diseases such as mastitis, respiratory diseases and enteric diseases including foodborne infections which continue to be a cause of public concern such as salmonellosis, campylobacter and E coli 0157H7. This work is also central to the ongoing MAFF response on concern relating to resistance arising from the antibiotic treatment of animals.

MAFF research is leading the way on finding alternatives to pharmaceutical control of diseases by developing vaccines for a range of diseases including sheep scab.

MAFF

1 March 2000

APPENDIX 26

Memorandum submitted by the Department of Trade and Industry (excluding the Office of Science and Technology)**INTRODUCTION**

1. The Department spends some £350 million per annum on supporting science and technology activities across a broad range of sectors. The aim is to encourage increased innovation through the effective exploitation of technology and knowledge for the benefit of the UK economy. This expenditure is reported annually through the Forward Look of Government-funded Science, Engineering and Technology.

SCIENCE AND TECHNOLOGY PROGRAMMES

2. DTI funds S&T under four budget headings: Innovation, Aeronautics, Space and Energy. The main purpose of this funding is to provide grants to industry and business support organisations to address market failures and to improve the competitiveness of UK industry. The bulk of DTI S&T support is in the form of collaborative, competitive grants, or single company grants (eg in the case of Smart awards) and is distributed across a wide range of sectors and types of organisations.

3. The main S&T programmes under each of the budget headings are described below (actual expenditure is described in the Forward Look summary table at Annex A):

Innovation

This is the largest S&T budget, covering a wide range of activities to support R&D and knowledge transfer activities. Including support for standards and the Department's policy and statutory responsibilities. The Innovation Budget is helping drive forward the initiatives announced in the Competitiveness White Paper¹. A range of targeted programmes will address the cultural barriers to entrepreneurship and innovation and facilitate the exploitation of the knowledge base, including continuation of the successful LINK scheme to encourage collaborative R&D projects, and the new DTI/DfEE reach-out fund to encourage more effective knowledge transfer between universities and business. They will also promote skills and best practice including an expansion of the successful TCS scheme to promote the movement of people and knowledge between industry and the science base.

Aeronautics

This comprises the Civil Aircraft Research and Technology Demonstration programme (CARAD) which supports pre-competitive, collaborative, long-term research and technology demonstration across the range of inter-dependent aircraft technologies. DTI also provides specific support to the aerospace industry through launch investment which currently generates a positive cash flow to the Government.

Space

The Department supports the UK space programme through the British National Space Centre (BNSC) which co-ordinates UK civil space activities by investing in the European Space Agency's (ESA) programmes and through a vigorous national programme; this includes the Space Foresight programme to encourage the creation of new networks between academia, research institutions and industry to explore how space technologies may be applied more widely.

Energy

Non-nuclear energy R&D is supported mainly through the expanded three year New and Renewable Energy programme, which helps the UK achieve its targets for the reduction of green-house gas emissions. The Cleaner Coal Technology programme assists UK business by providing a framework for UK industry and universities to develop and promote expertise and know-how in home and overseas markets. The Department's nuclear energy R&D support is now mainly directed at the Fusion Research programme, which is managed and undertaken by the UK Atomic Energy Authority (UKAEA). The programme funds UKAEA's contribution as host to the Joint European Torus (JET) and the UK national programme which is part of the EU's fusion research programme.

BUDGET AND PROGRAMME PRIORITY SETTING

4. The priorities for S&T activities are driven, at the strategic level, by the Department's overall agenda to build a successful UK economy which continually reinvests in its knowledge base to provide a flow of people, ideas and technologies. The overarching priorities for the Department's support following the Comprehensive Spending Review, were set out in the Government's Competitiveness White Paper.

5. Within this overarching framework, each of the budgets has its own priority setting mechanism according to the nature of the work (eg the Space Strategy, published in August 1999, was the subject of an extensive public consultation with UK space community). However, all programme priorities are developed

¹ Our Competitive Future: Building the Knowledge-Driven Economy" (Cm 4176), December 1998.

with advice from scientists, statisticians and economists from within the Department and a wide range of independent advisory committees and taking account of Foresight priorities. Programme committees chaired by the individual budget holders decide the ultimate programme priorities. For example, the Innovation Budget's programmes committee meets regularly to approve all proposals costing DTI £1 million or more. Senior representatives from around the Department look to ensure there is a broad range of programmes being undertaken to underpin the main objectives of the budget and to meet Ministers' priorities. The programme committees are co-ordinated through cross-representation of the budget managers and overseen by senior management, Ministers and, ultimately, the Secretary of State.

COMMUNICATION WITH OTHER GOVERNMENT DEPARTMENTS

6. DTI maintains close links with colleagues in other Government Departments and the Research Councils in the development of both research programmes and policy formulation. At the policy level, communication is maintained through the Ministerial Science Group and the Chief Scientific Adviser's Committee, which DTI's de facto chief engineer and scientist attends to represent ex-OST DTI. Daily contact is maintained with the Office of Science and Technology, mainly through DTI's Innovation Policy and Standards Directorate which co-ordinates ex-OST DTI S&T policy. Issues of cross-government interest eg, on biotechnology and environment, are discussed regularly with other Departments and Research Councils, both at working level and at senior and Ministerial level.

7. At programme level, DTI liaises with other Departments through jointly run programmes, cross membership of committees and advisory groups, trans-departmental working groups and concordats with eg, the Research Councils. The British National Space Centre, for example, which includes all Departments and Research Councils with interests in civil space, led by the DTI, provides an effective means of co-ordinating policy and programme management inter-Departmentally. The Department continues to look for improvement in communication and extra steps have been taken in the last few years to increase the "joined-up" thinking in the development of a science and innovation strategy. For example, DTI and DfEE have established a high level group attended by the Permanent Secretaries to improve the coherence and effectiveness of the two Departments' strategy on enhancing the exploitation of the knowledge base.

March 2000

Annex A

DEPARTMENT OF TRADE AND INDUSTRY: SCIENCE AND TECHNOLOGY EXPENDITURE

<i>Subject area</i>	<i>£m</i>	<i>1997-98 Outturn</i>	<i>1998-99 Estimated Outturn</i>	<i>1999-00 Plan</i>	<i>2000-01 Provision at Plan</i>	<i>2001-02 Provision at Plan</i>
Innovation and Technology Support of which:		179.3	180.4	194.1	223	230
Innovation Promotion & Support		78.8	62.4	58.9	67	72
Knowledge Transfer & Collaboration		39.3	43.0	61.7	91	95
Standards, Statutory & Regulatory		56.6	61.6	62.0	62	62
Sector Challenge		4.6	13.5	11.6	3	1
Aeronautics		23.0	20.3	19.7	20	20
Space of which:		103.0	88.0	89.3	90	90
National Space Programme		5.9	7.4	14.2	11	12
European Space Agency		97.1	80.6	75.1	78	78
Non-nuclear energy of which:		15.0	13.9	14.7	15	15
Offshore oil & gas						
—Industrial/technology support		1.2	1.0	1.0	1	1
—Enhanced oil recovery		1.6	1.2	1.0	1	1
Renewables		8.8	9.2	8.8	9	8
Clean Coal technology		3.4	2.4	3.9	4	5
Nuclear energy of which:		71.8	13.9	15.8	16	16
Fusion		16.6	12.6	14.5	15	15
Safety & acceptability		1.4	1.3	1.2	1	1
OST administration		5.1	5.4	6.2	6.0	6.0
TOTAL DTI S&T EXPENDITURE		343.3	322.0	339.7	369	377
Launch Aid (net)		-119.2	-180.2	-170.5	-186	-181

June 1999

APPENDIX 27**Further supplementary memorandum submitted by the Ministry of Agriculture, Fisheries and Food****PRIORITISATION OF MAFF R&D****INTRODUCTION**

1. The Ministry does not have a “free standing” research programme, in the sense that it does not fund research for research’s sake. The rationale for its R&D programme thus stands or falls on the basis of the Ministry’s policy aim and objectives. The Ministry funds research to support, inform and implement its policies and its regulatory enforcement activities; to provide scientific foresight; and to contribute to the identification of future policy options. Research is used in the formulation, appraisal and evaluation of MAFF’s policies and in their practical application to safeguarding public health, protecting the environment, conserving fish stocks and a wide range of other activities.

2. The Ministry’s Mission Statement for Science is:

“The Ministry encourages and funds pertinent science to inform and implement its current policies, to provide scientific foresight, and to contribute to the identification of future policy options. Research makes a significant contribution to the achievement of the aims of the Ministry and in particular to protecting the public and the environment and to encouraging efficient and sustainable agriculture, fishing and food industries.”

3. Within MAFF, responsibilities for prioritising and managing R&D expenditure and activities are split between the policy customers and the Chief Scientist’s Group (CSG), although final decisions on budget allocation are ultimately subject to Ministerial approval. A diagram illustrating the prioritisation mechanism, including input from external sources (such as independent advisory committees) is at Annex A. The following sections provide more detailed information on each aspect of the process.

ROLE OF POLICY GROUPS

4. Policy customers are responsible for their research budgets and for the direction of their research programmes. The R&D budget is allocated to MAFF Policy Groups across almost 40 separate policy programmes (see Annex B). In considering research plans, Policy Groups agree the underlying rationale for the research with CSG staff and MAFF economists. They then identify their research requirements and set policy and scientific objectives in liaison with CSG. Once research has been commissioned, Policy Groups are kept fully informed of progress and results from their research programmes and wider scientific developments by CSG.

ROLE OF CSG

5. CSG manages the research programme on behalf of the policy customers. CSG is responsible for the balance of the R&D programme across the Ministry; for ensuring the science is relevant and of good quality; and that individual programmes cover both strategic and more applied research, in line with MAFF’s research strategy. CSG is made up of over 100 staff, around half of whom are scientists. At any one time, CSG manages over 1,500 ongoing research projects at over 100 different contractors. CSG activities involve not only the appraisal, monitoring and evaluation of research, but also detailed contract negotiations; all R&D payments; IP policy, technology transfer and other dissemination activities; and general MAFF R&D policy.

DOUBLE-LOCK

6. The close liaison between CSG and MAFF policy customers is governed by a system known as the “double-lock”. This is designed to ensure that both policy and scientific objectives are given equal weight in all decision-taking and no projects are commissioned unless both CSG and policy customers are in agreement as to their value. Clear guidance on the “double-lock” system is issued to policy and CSG staff in the form of an R&D Handbook.

PRIORITISATION/FLEXIBILITY

7. For the last five years, MAFF has operated a system to allow for the freeing-up and redistribution of 5 per cent of the R&D budget each year. This “Flexibility” exercise was established to ensure that the appropriate balance and range of research was maintained and that high priority areas could be funded.

8. Policy Groups are required to offer up 5 per cent of their baselines from work coming to an end and then invited either to make bid-backs to continue the work, or bid for new, more important work. The Chief

Scientist meets with the Head of each Policy Group to discuss their bids. Following these meetings, the Chief Scientist prepares a paper for the R&D Committee summarising his recommendations on priorities for funding across the entire research programme.

R&D COMMITTEE

9. The R&D Committee is currently the high level committee responsible for making all major decisions affecting the R&D programme and R&D budget. The R&D budget is ring-fenced and changes to it cannot be made without the agreement of the Committee. The Committee is currently chaired by the Permanent Secretary and is made up of senior MAFF management.

10. The Minister has recently approved proposals to change the remit and membership of this Committee. Officials are now working to establish a new "Science Committee". This will still be responsible for decisions on MAFF research priorities and funding, but its remit will also cover non-R&D science activities (eg surveillance and monitoring) and wider aspects of R&D policy such as dissemination of data and commissioning policy. In addition, membership will be widened to include external representatives from the scientific community, industry and consumer organisations. The new Committee is expected to be established later this year.

MINISTERIAL INVOLVEMENT

11. Final decisions on the overall level of R&D spending within MAFF and on allocations to individual research programmes (see Annex B) are taken by Ministers, following recommendations made to them by the R&D/Science committee.

INDEPENDENT ADVICE ON R&D PRIORITIES

12. Through the entire research commissioning and prioritisation processes, MAFF encourages and relies on the best available independent scientific advice. This is provided through a range of scientific advisory committees (eg Advisory Committee on Novel Foods and Processes; Advisory Committee on Pesticides; Farm Animal Welfare Council; Microbiological Safety of Food Advisory Committee; and Spongiform Encephalopathy Advisory Committee).

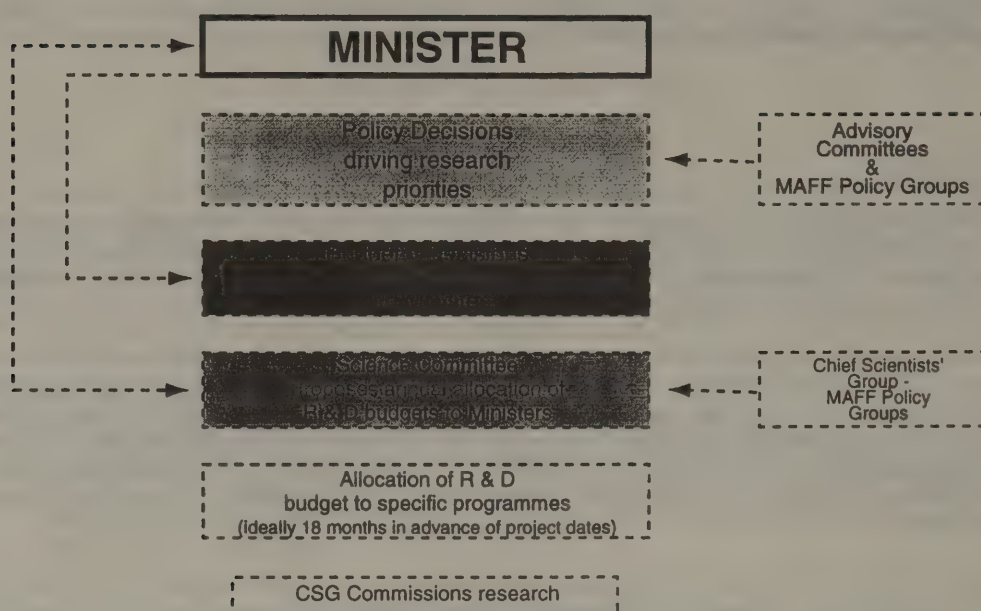
13. In addition, MAFF operates comprehensive co-ordination systems to ensure that all MAFF "stakeholders" are provided with every opportunity to input to discussions on the future direction of MAFF R&D programmes. These include:

- a number of research funders groups (eg on Agriculture, Food and Fisheries, TSEs and OPs);
- regular reviews of areas of MAFF-funded R&D, involving external experts, CSG and MAFF policy staff, contractors, other research funders and other interested parties, eg industrial or environmental bodies;
- formal concordats with MAFF's main research partners (eg FSA, BBSRC, NERC, MRC, Environment Agency);
- active participation in the Foresight programme and other central initiatives, such as implementation of the Chief Scientific Adviser's guidelines on the *Use of Scientific Advice in Policy Making*;
- continuous dialogue with OGDs (including CSA and other Chief Scientists through CSAC), the scientific community and other stakeholders through the day to day work of policy and CSG staff;
- full consultation (during 2000) on MAFF's new Research Strategy for 2001–2005, to ensure all stakeholders have the opportunity to comment on MAFF research priorities.

14. Finally, MAFF also operates a programme of independently conducted *ex post* evaluations of individual research programmes, the results of which feed back into MAFF policy and procedures in commissioning and prioritising the R&D programme.

Chief Scientist's Group

March 2000



Annex B

<i>New</i>	<i>Programme Title By</i>	<i>Baseline</i>	<i>Baseline</i>	<i>Baseline</i>
<i>Code</i>	<i>MAFF Objective</i>	<i>1999/00</i>	<i>2000/01</i>	<i>2001/02</i>
PH010	BSE and Scrapie	15,305	15,305	15,081
PH020	Zoonoses	7,590	7,399	7,304
PH030	Veterinary Medicines	1,760	1,684	1,646
PH040	Pesticides Safety	6,985	6,817	6,668
PH050	Food Safety	6,958	6,891	6,758
PH060	Food Hygiene	4,236	4,195	4,114
PH070	Radiological Prot & Food Contamin	900	891	874
PH080	Food Quality & Nutrition	6,622	6,559	6,432
PH090	Feedingstuffs & Fertiliser Standards	80	79	78
Total	Public Health	50,436	49,820	48,955
EN010	ESAs			
EN020	Countryside Stewardship			
EN030	Conservation	2,236	2,212	2,170
EN040	Farm Woodlands	804	790	774
EN050	Environment Protection	8,093	8,016	7,861
EN060	Aquatic Environment	4,203	4,113	3,953
EN070	Organic Farming	2,139	2,139	2,139
EN080	Countryside Management	1,135	1,123	1,078
EN090	Salmon Whaling & Inland Fisheries	578	572	561
EN110	Land Use & Tenure	48	47	47
EN130	Alternative Crops	1,085	1,072	1,052
Total	Environment	20,321	20,084	19,635
TM020	Arable Crops	6,642	6,566	6,440
TM050	Beef	1,096	1,086	1,065
TM060	Sheep	2,632	2,606	2,556
TM070	Pigmeat	1,299	1,286	1,261
TM080	Eggs and Poultry	1,172	1,160	1,138
TM090	Milk and Milk Products	2,107	2,087	2,046
TM100	Horticulture, Potatoes & Medit Crops	11,131	11,021	10,807
TM120	Food Industry & Competitiveness	2,804	2,777	2,723
TM140	Plant Varieties and Seeds	333	330	324
TM170	Fish Farming & Shellfish Production	2,261	2,194	2,126
TM180	Animal Disease Control	5,664	5,571	5,439
TM190	Plant Health	695	671	644
Total	Thriving Markets	37,835	37,355	36,569
ES010	Rural Economy	93	92	90
Total	Economic/Social	93	92	90
FS010	Conservation of Sea Fish Stocks	3,434	3,379	3,285
Total	Fish Stocks	3,434	3,379	3,285
WS010	Farm Animal Welfare	3,702	3,666	3,595
Total	Welfare Standards	3,702	3,666	3,595
FE010	Flood and Coastal Defence	2,579	2,579	2,579
Total	Fooding/Erosion	2,579	2,579	2,579
SA020	Genetic Resources	440	436	427
Total	Safeguarding Availability	440	436	426
SP010	Science Policy	6,510	6,345	6,018
	Seedcorn		594	1,197
Total	Supporting Programmes	6,510	6,939	7,215
DH18Mar'00	Grand Total	125,350	124,350	122,350

APPENDIX 28

Further letter to the Clerk of the Committee from the Parliamentary Clerk, Ministry of Agriculture, Fisheries and Food

Further to your third follow-up letter to Dr Shannon of 16 March, I attach a table (Table 1) showing how the cuts to the MAFF R&D budget made in the Comprehensive Spending Review (CSR) have been attributed. This is essentially the same table as submitted with the paper attached to my letter of 6 March, but with 1998–99 budget information included. However, it may be helpful if I provide some background to the decisions taken by Ministers in re-prioritising the research programme.

In applying these cuts, the Minister took the decision to protect, and where necessary enhance, a number of priority areas. For 1999–2000, he approved significant increases to the BSE and Scrapie, Zoonoses and Organic Farming programmes to reflect MAFF's expanding research needs in these areas. In addition, all the food research programmes due to transfer to the Food Standards Agency were protected (subject to some minor internal changes), as was the Flood and Coastal Defence programme. The budget cut in this year was otherwise spread equally across all the unprotected research programmes.

For 2000–01 protection was maintained for the BSE and Scrapie, Organic Farming and Flood and Coastal Defence programmes and elements of the Zoonoses programme, but the cut was otherwise spread equally across all others. The allocation of the CSR cuts has meant that policy customers have had to delay or forego new projects in most areas of MAFF business. However, MAFF has ensured that all existing research contracts have been honoured.

Since these decisions were taken, funding has been transferred from a number of policy programmes to create a separate "Seedcorn" account within the Science Policy programme (see bottom of table). This accounts for the minor reductions shown from 2000 onwards against several programmes, including those that have been protected. Seedcorn funding is provided to MAFF's scientific Agencies (CEFAS, CSL and VLA) to enable them to improve their capabilities and the services they provide to MAFF. This change aims to provide the Agencies with a more stable funding base to allow them to plan ahead.

Finally, the attached table does not take account of the transfer of over £20 million of the R&D budget to the Food Standards Agency, due to take place on 1 April 2000, or of a recently successful bid to the centre for new research under the BSE and Scrapie programme (£670k in 2000–01 and £4,340k in 2001–02). I attach, for information, a second table (Table 2) showing the breakdown of the MAFF R&D programme following these latest changes.

I trust that this now provides all the information you require.

22 March 2000

<i>New</i>	<i>Programme Title By</i>	<i>Baseline</i>	<i>Baseline</i>	<i>Baseline</i>	<i>Baseline</i>
<i>Code</i>	<i>MAFF Objective</i>	<i>1998-99</i>	<i>1999-00</i>	<i>2000-01</i>	<i>2001-02</i>
PH010	BSE and Scrapie	13,702	15,305	15,305	15,081
PH020	Zoonoses	4,395	7,590	7,399	7,304
PH030	Veterinary Medicines	1,939	1,760	1,684	1,646
PH040	Pesticides Safety	8,010	6,985	6,817	6,668
PH050	Food Safety	6,958	6,958	6,891	6,758
PH060	Food Hygiene	4,264	4,236	4,195	4,114
PH070	Radiological Prot & Food Contamin	990	900	891	874
PH080	Food Quality & Nutrition	6,622	6,622	6,559	6,432
PH090	Feedingstuffs & Fertiliser Standards	88	80	79	78
Total	Public Health	46,968	50,436	49,820	48,955
EN030	Conservation	2,468	2,236	2,212	2,170
EN040	Farm Woodlands	886	804	790	774
EN050	Environment Protection	8,917	8,093	8,016	7,861
EN060	Aquatic Environment	4,541	4,203	4,113	3,953
EN070	Organic Farming	1,139	2,139	2,139	2,139
EN080	Countryside Management	1,251	1,135	1,123	1,078
EN090	Salmon Whaling & Inland Fisheries	638	578	572	561
EN110	Land Use & Tenure	53	48	47	47
EN130	Alternative Crops	1,196	1,085	1,072	1,052
Total	Environment	21,089	20,321	20,084	19,635
TM020	Arable Crops	7,340	6,642	6,566	6,440
TM050	Beef	1,208	1,096	1,086	1,065
TM060	Sheep	2,899	2,632	2,606	2,556
TM070	Pigmeat	1,230	1,299	1,286	1,261
TM080	Eggs and Poultry	1,090	1,172	1,160	1,138
TM090	Milk and Milk Products	2,721	2,107	2,087	2,046
TM100	Horticulture, Potatoes & Medit Crops	12,273	11,131	11,021	10,807
TM120	Food Industry & Competitiveness	3,138	2,804	2,777	2,723
TM140	Plant Varieties and Seeds	367	333	330	324
TM170	Fish Farming & Shellfish Production	2,492	2,261	2,194	2,126
TM180	Animal Disease Control	5,928	5,664	5,571	5,439
TM190	Plant Health	798	695	671	644
Total	Thriving Markets	41,484	37,835	37,355	36,569
ES010	Rural Economy	102	93	92	90
Total	Economic/Social	102	93	92	90
FS010	Conservation of Sea Fish Stocks	3,783	3,434	3,379	3,285
Total	Fish Stocks	3,783	3,434	3,379	3,285
WS010	Farm Animal Welfare	4,078	3,702	3,666	3,595
Total	Welfare Standards	4,078	3,702	3,666	3,595
FE010	Flood and Coastal Defence	2,579	2,579	2,579	2,579
Total	Flooding/Erosion	2,579	2,579	2,579	2,579
SA020	Genetic Resources	450	440	436	427
Total	Safeguarding Availability	450	440	436	427
SP010	Science Policy	7,467	6,510	6,345	6,018
	Seedcorn			594	1,197
Total	Supporting Programmes	7,467	6,510	6,939	7,215
Grand Total		128,000	125,350	124,350	122,350

<i>New</i>	<i>Programme Title By</i>	<i>Baseline (£k)</i>	<i>Baseline (£k)</i>	<i>Baseline (£k)</i>
<i>Code</i>	<i>MAFF Objective</i>	<i>1999-00</i>	<i>2000-01</i>	<i>2001-02</i>
PH010	BSE and Scrapie	15,305	13,450	17,348
PH020	Zoonoses	7,590	7,399	7,304
PH030	Veterinary Medicines	1,760	1,684	1,646
PH040	Pesticides Safety	6,985	6,817	6,668
Total	Public Health	31,640	29,350	32,966
EN010	ESAs			
EN020	Countryside Stewardship			
EN030	Conservation	2,236	2,212	2,170
EN040	Farm Woodlands	804	790	774
EN050	Environment Protection	8,093	8,016	7,861
EN060	Aquatic Environment	4,203	4,113	3,953
EN070	Organic Farming	2,139	2,139	2,139
EN080	Countryside Management	1,135	1,123	1,078
EN090	Salmon Whaling & Inland Fisheries	578	572	561
EN110	Land Use & Tenure	48	47	47
EN130	Alternative Crops	1,085	1,072	1,052
Total	Environment	20,321	20,084	19,635
TM020	Arable Crops	6,642	6,566	6,440
TM050	Beef	1,096	1,086	1,065
TM060	Sheep	2,632	2,606	2,556
TM070	Pigmeat	1,299	1,286	1,261
TM080	Eggs and Poultry	1,172	1,160	1,138
TM090	Milk and Milk Products	2,107	2,087	2,046
TM100	Horticulture, Potatoes & Medit Crops	11,131	11,021	10,807
TM120	Food Industry & Competitiveness	2,804	2,777	2,723
TM140	Plant Varieties and Seeds	333	330	324
TM170	Fish Farming & Shellfish Production	2,261	2,194	2,126
TM180	Animal Disease Control	5,664	5,571	5,439
TM190	Plant Health	695	671	644
Total	Thriving Markets	37,835	37,355	36,569
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FE010	Flood and Coastal Defence	2,579	2,579	2,579
Total	Flooding/Erosion	2,579	2,579	2,579
SA020	Genetic Resources	440	436	427
Total	Safeguarding Availability	440	436	427
SP010	Science Policy	6,510	6,225	5,901
	Seedcorn		594	1,197
Total	Supporting Programmes	6,510	6,819	7,098
Grand Total		125,350	103,760	106,244

APPENDIX 29

Letter to the Chairman of the Committee from Lord Sainsbury of Turville in Response to Questions from the Clerk of the Committee

I am writing in response to Jessica Mulley's letter of 22 February, concerning the additional points that the Committee wished to raise with me and Sir Robert May as part of their inquiry into Government expenditure on R&D and the Forward Look.

Our responses are attached. Should the Committee require further clarification on these or any additional points, please do let me know.

RESPONSES TO POINTS RAISED IN JESSICA MULLEY'S LETTER OF 22 FEBRUARY 2000**(A) MATTERS ARISING DURING THE MEETING**

Committee Question (a)(i) How far is the reduction of MAFF'S R&D expenditure over the current Parliament attributable to the transfer of certain research institutions to the private sector?

Reductions in MAFF R&D expenditure in recent years (since May 1997) have been solely attributable to the level of MAFF budgetary settlements through the Comprehensive Spending Review and Ministerial decisions on internal funding allocations. There have been no reductions to R&D spending as a result of privatisations of research establishments. The only MAFF research establishments to have been privatised in recent years was ADAS (1 April 1997). No transfer of R&D funding was involved in this privatisation. MAFF has ongoing contracts of £11 million per annum with ADAS.

Committee Question (a)(ii) What is the precise nature of the concern expressed by Sir Robert May about the trend in R&D expenditure by the Ministry of Defence and the way in which the relevant decisions have been reached?

Since the early 1990s, MOD research expenditure has declined by 40 per cent in real terms (as indicated in the recent report by the Defence Committee). Total defence expenditure has declined by only about 25 per cent. The proportion devoted to research has fallen from around 3 per cent to a likely 2 per cent. By way of comparison, most of UK's allies with significant research spending are believed to spend between two and 3 per cent. Although unambiguous data are hard to come by, it remains Sir Robert May's best judgement that the proportion of the defence budget spent on research in countries such as the US, Germany and Sweden remains generally constant against a decline in the UK. The effects of the decline have been offset to some extent by the improvements in efficiency within DERA. However, there remains a concern that if the trend in research expenditure continues downwards it could ultimately affect defence capability. In addition, OST evidence submitted to an House of Commons Defence Committee inquiry on defence research¹ noted that there were a number of wider economic benefits resulting from the MOD's research which also needed to be taken into account in reducing R&D funding.

"First, the MOD commissions a good deal of the research from companies and usually contributes half the expense, enabling industry to acquire competence at a subsidised cost. Secondly, the fruits of research carried out at DERA, still the MOD's main supplier, are often transferred to industry, sometimes without charge, sometimes in an IPR exchange with industry, and sometimes on a commercial royalty basis. Thirdly, industry benefits when DERA researchers leave to take up posts in companies (DERA is the largest research institute in Europe). Fourthly, industry benefits from the extensive facilities (such as windtunnels) which have been established at DERA at public expense. A commercial rate is charged but this does not reflect the capital costs of their establishment."

Committee Question (a)(iii) There are several different players involved in advising Ministers, in co-ordinating departmental R&D programmes and in drawing those programmes together into a coherent whole which reflects overall Government priorities. Could you clarify the precise role played by (a) the OST, (b) the CSA, (c) the MSG, and (d) CSAC in co-ordinating departmental R & D programmes?

OST

The Transdepartmental Science and Technology Group (TDST) within OST has a general and open-ended responsibility to support the CSA in keeping all publicly funded S&T related activity under review and ensuring that important cross-cutting issues are effectively handled. The Group's role is to act as advisor and facilitator. OST/TDST draws mainly upon its links and regular dialogue to pick up cross-cutting issues which require action.

¹ House of Commons Defence Committee ninth report 1998/99, page 86.

For example, OST/TDST led the review of the advisory and regulatory framework for biotechnology, and the two commissions: Human Genetics Commission and AEBC will have a remit to keep this framework under review. It holds regular meetings with the Research Councils to look at forthcoming research outputs which are likely to have an impact on Government science policy and/or public perception. As the secretariat to the Council for Science and Technology (CST), OST/TDST provided support to the CST's publication "Review of S&T Activity Across Government". OST co-ordinates and provides the secretariat for the Foresight Official's Group which, amongst other things, considers how Foresight is taken forward across Government. OST participates in Inter-Agency Committees, on marine science and global environmental change, which maintain an overview of research in their respective fields. OST chairs and funds the first of these. In the field of biotechnology, OST provides the secretariat for IGGMOT. OST also has joint responsibility with the Cabinet Office for providing support and the secretariat for the Cabinet Committee on Biotechnology. Sir Robert May, in his capacity as Chief Scientific Adviser also attends this Committee as an observer. Other issues picked up and addressed by the OST have included resistance to antibiotics, Vitamin B6, sports science, science centres and herbal products.

Further information on the role is included in the OST's memorandum to the Committee's Inquiry into the Scientific Advisory System.²

CSA

The CSA provides advice to the Prime Minister, to Ministers collectively and to individual departments. This includes co-ordinating activity on strategic issues, in relation to funding, balance and direction of S&T activity. Decisions on the balance of priorities are, of course, a matter for collective decisions by Ministers.

In terms of formal management chains, the CSA has no direct management responsibility for Departmental Chief Scientists. His role is rather to provide advice and seek to influence as necessary. He maintains regular contact with departmental Chief Scientists through their membership of the Chief Scientific Adviser's Committee, which he chairs and for which OST/TDST provides the secretariat and through bilateral as well as informal contracts. The CSA is also responsible for advising the Prime Minister, the Cabinet, and the Secretary of State for Trade and Industry (in the latter's capacity as Cabinet Minister for Science) on S&T issues.

As Head of OST, CSA is responsible for its transdepartmental functions which include advising Ministers on issues arising on S&T expenditure, co-ordinating activity on issues of a key cross-departmental nature, and taking forward a number of specific transdepartmental activities such as Foresight and LINK.

MSG

The Ministerial Science Group is chaired by Lord Sainsbury. Its membership comprises Ministers from each of the departments with significant S&T activity, including the devolved administrations. The secretariat is provided jointly by OST and the Cabinet Office. MSG is an informal committee which aims to promote a co-ordinated and coherent approach to S&T policy-making across Government. Its role will include the review of departmental science strategies. It also has responsibility for considering issues relating to the Government's policy on science, engineering and technology, including the development of the Foresight Programme and implementation of the Chief Scientific Adviser's guidelines on the use of scientific advice in policy making.

CSAC

The Chief Scientific Adviser's Committee (CSAC) replaced EASO as the main official-level cross-departmental forum for discussion of S&T issues, following devolution. The new arrangement meant that officials of the devolved administrations could no longer see Cabinet Committee papers or be involved in discussions which became Cabinet Committee advice. Its membership covers all departments with interests in S&T, and is normally at Chief Scientist level or equivalent. Like MSG, CSAC does still include members from the devolved administrations. In addition to its role as a forum for general discussions of S&T issues, CSAC can also be used to prepare business for the MSG. The terms of reference for CSAC are:

1. To consider issues of relevance to Her Majesty's Government and the devolved administrations in Scotland and Wales concerning science, engineering and technology (SE&T). In particular:
 - To provide advice to Ministers, primarily through the Ministerial Science Group.
 - To discuss and facilitate implementation of policy on SE&T.
 - To identify and promulgate good practice in SE&T-related areas, including the use of scientific advice in policy making.
 - To facilitate communication on particular high profile SE&T-related issues and those posing new challenges for Government.

² Memorandum of 17 June 1998.

2. Experts on specific issues may be invited to attend or address CSAC when required. Invitations will be given by the Secretariat following consultation with members.

(B) QUESTIONS NOT REACHED AT THE MEETING

Committee Question (b) (i) How frequently will departmental science strategies be reviewed and in what form will they be published?

The Ministerial Science Group has yet to decide on the frequency of review of departmental science strategies. It is likely, however, that MSG will begin its first overview of all departmental strategies in Spring 2001, prior to their implementation at the start of the financial year 2001–02.

Committee Question (b) (ii) The CST has pointed out that the decision-making process regarding R&D spending in government departments is quite varied, with the decisions being made by the relevant policy areas in some departments, whilst in others the decisions are taken centrally. What, in your view, are the respective advantages and disadvantages of these different approaches? Have you made any attempt to analyse whether one system or another leads to measurably better results in terms of clarity of priorities and value for money?

It is a matter for individual departments to organise their internal structures in a way which best suits their policy responsibilities. As the CST “Review of S&T Activity across Government” notes, a centralised approach to R&D budgets has the advantage of pooling research management expertise and providing the flexibility to re-allocate resources to meet changing needs. In contrast, a de-centralised approach ensures that research programmes are linked directly to an individual policy area and support the corresponding policy objectives. There is no evidence to suggest that one approach has clear advantages over the other. What is important, is that each department should have ownership of its own strategy and arrangements.

Committee Question (b) (iii) MAFF's R&D spending has shown a progressive decline over the last 10 years despite there having been a number of crises in areas of MAFF responsibility—such as BSE and E Coli food poisoning. What input did the Chief Scientific Adviser have, or attempt to have, into these funding decisions? Did his intervention produce any reconsideration by MAFF of its overall priorities for R&D?

As part of the Spending Review, the Chief Scientific Adviser advises Ministers on issues arising on S&T expenditure across relevant areas of Government, and about the proposed funding for particular areas of work where he judges it necessary to comment. The final decisions on the funding of the programmes of individual departments will reflect all relevant considerations, of which the CSA's views are only one input. In the 1997–98 Comprehensive Spending Review, the CSA commented on the implications of the possible settlement for MAFF. His views would have been one of a number of factors to be taken into account.

Committee Question (b) (iv) What regular overview and analysis, if any, is undertaken by the OST (or any other Government agency) of all scientific programmes, by subject, across the whole of Government?

OST does not have a regular programme for analysis of scientific programmes by subject. Rather, it uses the networking and other arrangements described in the evidence to the Committee to identify issues for which systematic review and monitoring is required. Examples include the decisions to establish IACGEC and IACMST.

Committee Question (b) (v) Some of the Committee's witnesses have complained about the change to a slimmed down format for Forward Look and the removal of certain information previously contained in the document. Will you consider these criticisms and suggestions in time for the next edition?

The change in format was intended to encourage more people to read Forward Look by making it more succinct and accessible to readers. It also made it easier to place the document on the OST website. The website document has had an average of 700 visitors per month, over the last four months, and is in an easily downloadable format. A total of around 1,200 copies of the document have been sold by The Stationery Office, to date (ie over a period of some six months).

The content of Forward Look 1999 is similar to previous editions although it did not repeat material that is covered elsewhere, such as Foresight and international comparisons. Instead it includes pointers/hyperlinks to these documents. OST welcomes any suggestions that people have as to how future editions of Forward Look might be improved. The OST website also has a “Feedback” page where anyone can e-mail suggestions or general comments, not only on Forward Look, but any aspect of OST. OST noted from the oral evidence given by Save British Science to this inquiry on 2 February 2000 that they had some concerns about the revised format. OST is following this up with them. OST is aware of no other criticisms.

Committee Question (b) (vi) Is it the intention in future to time publication of Forward Look to coincide with the Comprehensive Spending Review?

One of the key objectives of the Forward Look is to present the Government's planned expenditure for SET. OST believes it makes sense to time publication to follow with the outcome of the Spending Reviews. Accordingly, the intention is to produce the Forward Look on a publishing cycle which reflects the timing of future Spending Reviews. Departments do adjust spending plans between Spending Reviews and the intention is to publish any revised year-by-year data in the *Science Engineering & Technology Statistics*.

Committee Question (b) (vii). Do you accept the case argued by some of the Committee's witnesses that Forward Look should publish spending figures covering a somewhat longer historical timespan (perhaps giving data for alternate, or every three years, for the earliest period)?

The 1996 Forward Look provided data going back for 13 years whilst the 1999 edition provides data covering 16 years. OST believes that Forward Look should be as helpful as possible to readers in providing a timed series of data covering the most useful timespan. If there are any proposals for improving the content or presentation of the data, OST would be happy to consider them.

8 March 2000

APPENDIX 30

Letter to the Clerk of the Committee from Dr David Fisk, Chief Scientist, Department of the Environment, Transport and the Regions following the Evidence Sessions of 1 March.

In your letter of 3 March you included a number of questions which the Committee did not have time to deal with when I appeared on 1 March. Please find enclosed my answers to the Committee's questions. I would, of course, be happy to provide further information if required.

SUPPLEMENTARY QUESTIONS TO DETR

1. *Your memorandum states that research programmes are reviewed on a five year time scale, in conjunction with DETR's policy review cycle. How does this process fit in with the 2-3 year time frame for the Comprehensive Spending Review? Do you use external assessors for these five-yearly reviews?*

In DETR policy programmes are evaluated at least every five years to a timetable agreed at Board level. These evaluations are synchronised whenever possible with relevant Quinquennial reviews, and Better Quality Service reviews and any special studies associated with Spending Reviews. Assessment of research programmes takes place at the same time as the relevant policy review. In general, external reviewers conduct the formal research evaluations. The evaluations result in a new ROAME statement (Rationale, Objectives, Assessment, Monitoring and Evaluation). The research review may take place before the policy evaluation if this will assist the latter. Where a policy review or spending review leads to major change in policy this is taken as an opportunity to redirect the research strategy. Progress towards the strategic goals is also reviewed annually in order to inform budget decisions.

2. *What criteria and what procedures do you and your colleagues use to judge whether individual R&D programmes are delivering value for money?*

Our major tool for assessing the value for money from research is the research evaluations. It is STP's task to ensure that programmes are managed according to clear principles, using ROAME statements as a basis for ensuring research objectives are consistent with the needs of policy support. Evaluations test both whether the programme objectives have been met and whether the research results have produced an impact on policy that justified the costs to the relevant programme expenditure. We currently base our methodology on the Cabinet Office 1989 guidance R&D Assessment, updated internally so as to take into account subsequent science policy developments.

3. *Your memorandum states that 60 per cent by value of R&D projects are subject to multiple tender. How does the Department allocate the 40 per cent not produced by multiple tender? Is this block of expenditure effectively already committed on a long-term basis to various institutions? If so, which are they?*

Multiple competitive tendering is the preferred process for commissioning DETR research contracts. Under DETR general procurement guidance there are two main exceptions: where single tender action is justified (due to capability, experience or security), or where a programme responds to external proposals (such as the LINK scheme). There may also be circumstances where we may wish to extend an existing multiple tendered project with the original contractor. Long term contracts with single contractors (eg to provide an immediate response capability) do not play a significant role in the DETR portfolio.

4. *What percentage of your Department's R&D contracts are for three years or less, four or five years, or more than five years respectively?*

We do not maintain this information centrally. Contract duration varies substantially, and is dependent upon the requirements of the project. Both DOE and DOT conducted surveys shortly before merger in 1997 and concluded that average project duration was around three years. This is the length of any one firm contractual obligation. A major research theme will be carried through a series of modules or overlapping projects, each covered by its own contract. Thus while any one contract may be only for three-four years, a group of research contractors may be working with the Department on a particular problem over a period of two to three times this length.

5. *Do you consider, inside DETR, what effect terminating a contractual programme will have on the viability of the institution concerned? Do you pay the redundancy costs of terminated staff? If not, who do you expect to pay, and where are they to get those funds from?*

It would be quite exceptional for DETR to terminate a contract before its completion if it is meeting its milestones successfully. It is more common to redirect research project aims than to terminate the project. However, if the situation should arise, the question of costs would be decided on the basis of the contract arrangements under which the work was commissioned. Following good procurement practice the DETR customer would also consider the possible longer-term effects on future capabilities in the research market. Our publications on the Web of our research strategy and research market prospects are intended in part to help potential contractors identify rising and declining areas of DETR interest well ahead.

6. *How many people work in the Science and Technology Policy Division and what are their qualifications? How does the STPD interact with the Department's various policy directorates; does it, for example, have its own equivalent policy sections?*

STP is located within DETR's Central Strategy Directorate. It has 17 staff, and is organised in areas that cross cut DETR research interests:

- Facilitating DETR links with the "Science base", including operating our Research Council Concordats.
- Implementing Government Science policy within DETR, in particular OST initiatives.
- Working as a team with other DETR Divisions on "futures" work, including Foresight.
- Improving DETR's internal research management practices, quality control processes and supporting personnel policy in relation to scientists.
- Linking DETR to international research (EC Framework Programmes and other international science activities).

The Division also manages for DETR several crosscutting research programmes (LINK and the Department's responsive mode "seed corn" research programme).

Eight of the staff are qualified scientists or engineers. The Division has close day to day working links with the Department's research managers, and the Head of Division is part of the DETR Senior Civil Service team.

7. *Do you or the STPD have any influence over the original budget allocations to the policy directorates, from which relevant R&D projects are funded.*

The Chief Scientist reports to the DETR Board on the research programme and its underlying strategy each year at strategic points in the bidding and funding cycles. This is an opportunity to point to areas where research effort may need to be reinforced, or to reaffirm decisions that would result in reduction of effort. For example, the Department responded positively to proposals to build up a research capability in local government policy, to make greater use of remote sensing technology in our environmental data collection, and to widen the social science base of data we collect on driver behaviour. The Chief Scientist has an opportunity to comment when programmes are submitted to Ministers for approval each year. Also if it were necessary, for example if a proposed programme did not accord with policy agreed in the Ministerial Science Group, the DETR Minister for Science also has an opportunity to intervene. The policy customer has to take the final view since they manage the research to its completion. If the Chief Scientist thought it necessary to offer a dissenting view it would be customary to back up that judgement with hard evidence, drawn, for example from research council, international or seed corn research findings.

8. *Seen from DETR's perspective, what is the proper role for the Chief Scientific Adviser and OST in monitoring departmental R&D expenditure and in seeking to co-ordinate it into a coherent whole which reflects the Government's overall priorities? How, in practice, does this relationship work? For example, how frequently will you talk to OST about a particular programme?*

The OST form a valuable role in ensuring that best practice is maintained in Government. This includes leading on the Forward Look so that programmes and research effort can be compared across Departments. OST have been instrumental in designing co-ordination mechanisms (such as the Inter Agency Committee on Global Environmental Change), and promulgating best practice such as the May Guidelines. They have also an important role in ensuring that Government programmes fully link into the European Community programmes. We would hope in the future, as Government seeks to take through the commitment in the Modernising Government White Paper to evidenced based policy making, that OST would also create a policy research programme of its own to better inform trans-departmental debate on science policy issues.

9. *Can you give examples of proposed R&D programmes in DETR where an intervention by the Chief Scientific Adviser has resulted in any adjustment of priorities, or switching in funding?*

No, but we would have treated such an event as signalling a breakdown in our working methods. We do discuss important programmes with the CSA at their formative stage, particularly if their outcome could have significance for Cabinet business. For example we have worked with successive CSA's on the development of the UK climate change programme. We are currently discussing with the CSA the importance to be given to supporting the GEDC Global Biodiversity Information Facility.

10. *How frequently, on average, do you meet the Chief Scientific Adviser to discuss your Department's R&D programme?*

The Chief Scientific Adviser's Committee is our formal opportunity to discuss Departmental R&D issues on a regular basis. As noted above this is supported by many informal contacts outside the meeting.

9 March 2000

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